PEASANT FARMING SYSTEMS IN THAILAND:

A COMPARATIVE STUDY OF RICE CULTIVATION

AND AGRICULTURAL TECHNOLOGY IN CHIANGMAI AND AYUTTHAYA

by

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ABSTRACT

This thesis describes and analyses two peasant rice farming systems established in the northern intermontane basins and the Chao Phraya delta of Thailand in a comparative perspective. The two distinctive farming systems, i.e. the Intermontane Basin and the Delta farming systems, are examined in ecological and socio-economic contexts with special emphasis upon the role of indigenous technology at both regional and village levels. Intensive fieldwork into the specified villages in Chiangmai and Ayutthaya provinces was conducted for 26 months mainly in 1974-75 with further visits in subsequent years.

The farming systems are first examined in the ecological context by investigating physiographical and hydrological conditions, methods and practices of irrigation and the consistent process of farming operations in rice cultivation. The labour-intensive and small-scale transplanting culture of the Intermontane Basin has been founded on the traditional irrigation systems mainly developed at village level. In many parts of the Delta, however, where units of cultivation are larger, broadcast-sowing culture has been adopted which depends basically on natural precipitation and annual inundation.

These contrasting farming systems, in which agricultural technology interacts with both ecological and socio-economic conditions, are in turn dominated by different forms of peasant agricultural production: subsistence production in the Intermontane Basin and petty commodity production in the Delta. The differentiation of the forms of peasant production is primarily derived from the complex of socio-economic conditions of the two farming systems stemming from the processes of land reclamation, land tenure and labour utilisation.

Thus we recognise within the farming systems two structures, ecological and socio-economic, which are closely interrelated through the farming technology prevailing amongst the peasants. Structural analysis of the contrasting farming systems reveals the complex reality of Thai peasant rice cultivation. It is reasonable to assume that any problems and changes in peasant agriculture can be detected most effectively by means of this structural approach.

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EXPLANATORY NOTES

1. Transliteration

The system of transliteration of Standard Thai (Siamese) and Lannathai used in the text follows basically Phya Anuman Rajadhon, "General System of Phonetic Transcription of Thai Characters into Roman", in The Nature and Development of the Thai Language, Bangkok, 1963, pp. 32-36. However, ü is substituted for u' for typographic convenience and ñ, a nasal consonant as in Spanish ñ, is introduced in the case of Lannathai. The conventional spelling, without underlining, is retained for some place names (e.g. Bangkok, not Krung Thep nor Phranakhǫn: Chao Phraya river, not Čhao Phraya river), for personal names according to the personal usage of the individuals involved (e.g. Anuman Rajadhon, not Anuman Ratchathon: Chulalongkorn, not Čhulalongkǫn), and for some common units of measurements (e.g. baht, not bat: rai, not rai).

2. Units of Measurement

Linear Measure

niu (niu fut)	= c. 1 inch	= c. 2.5 cm
sǫk (length from middle finger tip to elbow joint)		= c. 50 cm
wa		= c. 2 m
sen	= 20 wa	= c. 40 m

Area Measure

tarang wa	= c. 4 m^2

ngan	= 100 tarang wa	= c. 0.04 ha
rai	= 4 ngan	= c. 0.16 ha

Volume Measure

thang (unhusked paddy grain in Standard Thai)		= c. 20 l
tang (unhusked paddy grain in Lannathai)		= c. 30 l
kwian	= 100 thang	= c. 2000 l

Weight Measure

thang (unhusked paddy grain)		= c. 10.1 kg
kwian (unhusked paddy grain)	= 100 thang	= c. 1010 kg

Currency

satang	= 0.01 baht	
salüng	= 0.25 baht	
baht	= 4 salüng	= c. 2-2.5 pence in 1974-75
thep (Indian Rupee used in Lannathai region)		= c. 8 baht before 1960

3. Glossary of Lannathai and Standard Thai (Siamese) Terms

This brief list contains only major terms used frequently in the text; it does not cover all of the words in either Lannathai or Standard Thai occurring in the text. (L) signifies exclusively Lannathai terms, while (T) is reserved for Standard Thai exclusively. Otherwise, terms are commonly used in both languages.

amphoe	Administrative district
ao mü sai mü (L) ao raeng (T)	Reciprocal exchange of labour
čhap čhọng	Claiming wilderness for cultivation

čhoi (L) chuai (T)	Help, with connotations of unpaid labour service
dek chang ti khao (L)	Minors hired for threshing paddy
düan	Month
fai (L)	Traditional weir
hai (L) rai (T)	Upland field
hap čhang (L) rap čhang (T)	Wage labour
hitkọng mu fai (L)	Customary regulations of the irrigation control group
kae müang (L)	Irrigation headman
kamnan	Head of tambon
kha hua (L)	Token, nominal land rent
kha na	Riceland tax
kha pha koeng (L)	Land rent of sharecropping
kha tang nam (L)	Farm turnout fee
khaek čhang (T)	Hired guest
khao	Rice
khao hai (L)	Upland rice
khao kepwai kin	Paddy for home consumption
khao khün nam (T)	Floating rice
khlọng (T)	Canal
khọ khao	Begging for paddy
khọ raeng (T)	To ask for another's labour, usually in unpaid labour service
khon hap čhang (L) khon rap čhang (T)	Rural labourer
lak fai (L)	Weir stake
long khaek (T)	Reciprocal exchange of labour
luk čhang	Regularly hired labourer

mu fai (L)	Irrigation control group
müang (L)	Irrigation canal
müang fai (L)	Traditional gravity irrigation system
na	Rice field
na dam (T)	Transplanted rice field
na luang (T) na čhao (L)	Royal riceland
na ratsadǫn (T)	People's riceland
na wan (T)	Broadcast-sown rice field
nam	Water, river
nam müang (L)	Canal water
nam song (T)	Stagnant inundation
nam thuam (T)	Flood, flooding
ñat (L) ñat diao kan (L)	Bilateral kindred
pa sanguan	State-owned 'forest reserve'
pae (L)	Dry deciduous dipterocarp forest
pak tang nam (L)	Farm turnout
phi ban (L)	Guardian spirit of the hamlet
phi fai (L)	Guardian spirit of the weir
pi nǫng kan (L) phi nǫng kan (T)	Old-younger relationship
pǫ luang (L) phuyai ban (T)	Village headman
rahat (T)	Traditional water-raising device for irrigation
sak	Teak (Tectona grandis)
talang khao (L) lan nuat (T)	Threshing floor
tambon	Administrative sub-district
thai	Plough

tüng (L) phluang (T)	Dipterocarpus tuberculatus
wat	Buddhist temple, monastery

What a difference between the wife of a labouring man here, and the wife of a labouring man in the forest and woodlands of Hampshire and Sussex! Invariably have I observed that the richer the soil, and the more destitute of woods; that is to say, the more purely a corn country, the more miserable the labourers.

William Cobbett, Rural Rides, 1930

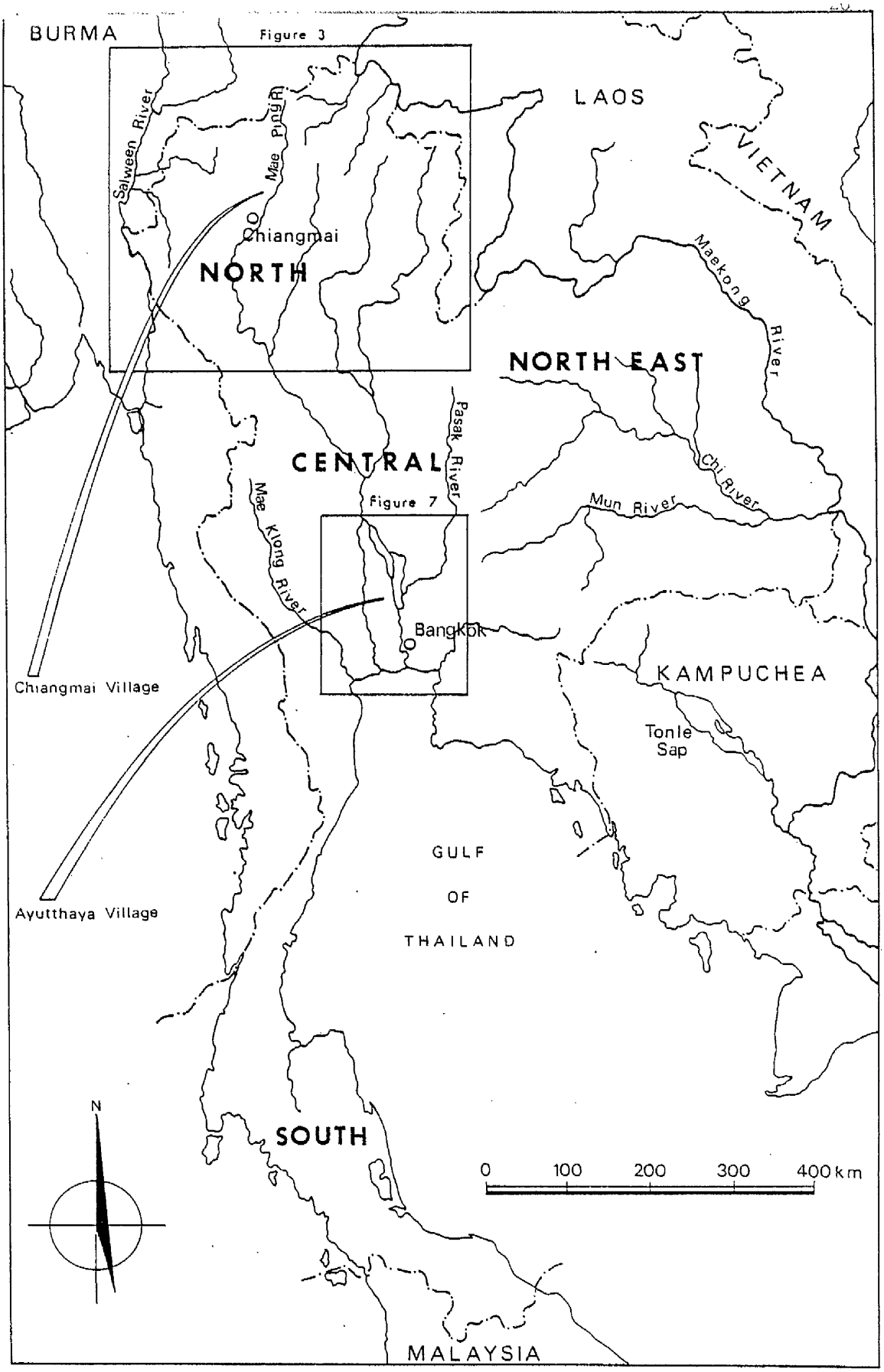


Figure 1: General Map of Thailand

CHAPTER I

PEASANT FARMING SYSTEMS:

THEORETICAL CONSIDERATIONS

1. Farming Systems in Agricultural Geography

The analysis and classification of agricultural patterns have long been basic concerns in agricultural geography. Since the pioneer works of Eduard Hahn and Derwent Whittlesey,a number of studies have been devoted to to typologies of agriculture and the systems of agricultural regions on a world scale (Hahn, 1892: 8-12; Whittlesey, 1936, 199-240; Kostrowicki, 1964: 111-146; Sapper, 1926: 124; Gregor, 1963; Fryer, 1965: 67-118; Oxford Economic Atlas, 1972; 7). In particular,the attempt to delimit the systems of agricultural regions and the comparison of specific aspects of agricultural systems with particular attention to their regional differentiation are still a major concern of geographers.[1] And these studies also have applied in various scale levels in the specified regions, accompanied by some theoretical consideration on the criteria used in classification (Chisholm, 1964: 91-92; Harvey, 1966: 361). The problems that emerged in these studies of agricultural systems will give rise to significant suggestions in this thesis, which aims to distinguish local types of farming systems within a limited area in the Chao Phraya water system in Thailand.

One of the major discussions common to these numerous works concerns the criteria adopted in the classification of agricultural systems. Some recent attempts are devoted to determining those criteria toward more comprehensive classification of typology (Grigg, 1974: 3; Barnes, 1965; Kostrowicki, 1964). As suggested by Grigg in his comprehensive review there have been, broadly speaking, two growing tendencies in the classification of agricultural systems: 1) The studies derived from the work of Derwent Whittlesey,which lay great stress on spatial variations in agriculture and its diversity of

practice, products, and organization; 2) The studies based on the system devised by Eduard Hahn, which mainly deal with forms of economies and emphasise differentiation of farming methods chiefly distinguished by the predominant implement used (Grigg, 1969: 95, 116, 127).[2] Although these attempts have been made on a world wide scale, similar methods can also basically be applied in classifying major characteristics of agriculture in an area where a single crop is homogeneously predominant. Within a limited area of rice cultivation like the Chao Phraya river basin, it is possible to clearly distinguish variations in land-use, land tenure and labour utilisation. Farming methods especially, appear to be one of the major variables with which to distinguish these variations.

The analytical framework emphasising farming method in relation to socio-economic attributes was developed by Hahn's successors in German agricultural geography.[3] Hahn's attempt to classify the evolutionary stages of subsistence activities was developed by Hans Bobek, who took into account further consideration of the socio-economic conditions such as livelihood forms and relations of production (Bobek, 1962: 220-221). Hahn's idea is also apparent in Leo Waibel's agricultural geography, in which the agricultural landscape is a major concept (Waibel, 1933: particularly Chapter 1). Subsequently there have been some important studies of agricultural systems in South East Asia, dealing with the agricultural landscape, which represents the interaction of nature and the economic activities of social groups (Credner, 1935; Pelzer, 1945; Uhlig, 1969; 1-23; Manshard, 1974: 50-127, 160-165).[4]

The significance of farming method, which was adopted in the studies of Hahn's followers is also stressed by Whittlesey. He points

out five items as 'functioning forms' or 'primary conditioning elements', which appear to dominate every type of agriculture as follows:

(1) The crop and livestock association.

(2) The methods used in growing the crops and producing the stock.

(3) The intensity of application to the land of labour, capital, and organisation, and the output of the product which results.

(4) The dispersal of the products for consumption (i.e., whether used for subsistence on the farm or sold off for cash or other goods).

(5) The ensemble of structures used to house and facilitate the farming operations (Whittlesey, 1936: 209).

In the South East Asian context, as a number of studies suggest, agriculture traditionally largely falls into two broad categories, the shifting cultivation system and the sedentary wet-rice cultivation systems, which are sometimes called swidden agriculture and sawah agriculture respectively (Pelzer, 1945: 4-9; Geertz, 1963: 15-37; Gourou, 1966: 118-139; Fryer, 1970: 39, 44). The present thesis, dealing with the latter system, is especially focused upon a limited area in Thailand in order to clarify local characteristics of agriculture. Thus the term farming system, when used in the context of this thesis, indicates local variations of a specific agricultural system rather than those variations in agricultural systems which are often be referred to on the world scale.

Taking into consideration Whittlesey's 'functioning forms', the wet-rice farming system with which we are here concerned in the context of Thailand and South East Asia may be interpreted according to his variables as follows:

(1) The major crop is rice.[5] Rice has been more significant than any other crop, as the staple crop of the majority of peasants for many centuries and as a cashcrop in more recent periods.

(2) The dominant method concerned here is the wet-rice cultivation method which includes considerable technical variations, but is basically practised within the complex mechanism of the flooded field ecosystem.

(3) The basic unit of production is a peasant family farm, cultivating a relatively small are of owned or rented land, mobilising basically domestic labour, supplemented at certain farming stages by outside resources such as co-operative labour and wage labour. The capital investment is relatively low, utilising a set of traditional tools and equipment, though industrial inputs have become popular during the past few decades.

(4) The products are basically assigned to home consumption with subsistence production predominant, but in particular areas rice cultivation has become petty commodity production directed toward market disposal.

Although his fifth variable can be closely associated with the spatial pattern of facilities of socio-cultural significance such as the plan of the farm compound or the material arrangement of co-operative facilities in a village, it should be appropriately discussed in relation to the other four variables.

At this point, we encounter significant problems involved in the conventional typological attempts within agricultural geography. One of the crucial problems common to these earlier contributions attempting to classify agricultural systems was the ignorance of relations between

the elements or criteria involved in classification. In most cases, they tended to fail to show how the elements actually work with one another in either the natural or the economic context underlying agriculture. Their attempts have been fundamentally typological and, for this reason, they have been hardly able to tackle the entity of an agricultural system in which various natural and socio-economic factors interact. Our major question is directed to how these factors are integrated into a farming system. Although the elements or variables put forward by the earlier attempts in formulating the theories of agricultural systems should be considered in the present thesis, our inquiry will be much more into the relations between factors in farming. It is thought that the concept of peasant technology, which embraces not only techniques but their relations to socio-economic conditions, might serve to elucidate the problem, as we shall discuss later. In a traditional agriculture, as Farmer suggests, a long-standing system of farming technology represents a strong relationship to local physical and socio-economic conditions (Farmer, 1968: 207).

As many geographical studies are concerned with problems of scale, the study of farming systems must also take into account this aspect (Chisholm, 1962: 27-28; Haggett, 1965: 263-265; Harvey, 1968: 71-78; Morgan, 1978: xii). Since this study starts from the assumption that wet-rice cultivation as an agricultural system uniformly developed in the major part of Thailand can be classified into some distinctive farming systems in terms of farming technology, it will first deal with their regional characteristics. The farming systems observed on a regional level should be further examined in intensive field investigations undertaken in specific villages. The regional study is followed by a detailed analysis based on the data obtained

from individual farm households in the two specified villages in order to examine the characteristics and problems of farming systems in the village context. In the course of discussion emphasis is laid on analysis based on the individual peasant farm, because that is the fundamental unit of production and distribution (Morgan and Munton, 1971: 3-4; Ruthenberg, 1976: 2-3; Grigg, 1974: 2). As Ruthenberg suggests, the peasant farm is "both an ecosystem and an independent unit of economic activity" (Ruthenberg, 1976: 2). In this sense a study of farming systems always has to start from the empirical reality observed on each peasant farm with special reference to both the ecological and socio-economic aspects of farming. The present study will also concentrate where appropriate on village communities, because peasant socio-economic activities, in many cases, are performed within a village framework.[6]

2. The Ecological Approach in the Study of Farming Systems

As the study of farming systems in agricultural geography is a part of economic geography, it has been mainly concerned with production processes, and has employed basic concepts of economics (Coppock, 1968; Morgan and Munton, 1971: 3-4). In recent years there has been a growing tendency to develop more sophisticated methods and deductive methods in analysing agricultural land-use patterns (Morgan and Munton, 1971: 4-6; Haggett and Chorley, 1967: 19-41). Devices such as inter-regional equilibrium models and decision-making models undoubtedly help to elucidate the analysis of agricultural activities in a special locational aspect (Harvey, 1966: 361-374; Henshall, 1967: 443-449).

On the other hand, as David Grigg and David Harris have clearly pointed out, agricultural geography has tended to ignore the relationships

of human activities to environment, and has moved only hesitantly towards ecological study (Grigg, 1967: 476-477; Harris, 1969a: 134). Since the ecosystem approach provides a functional structured framework for analysing natural, socio-cultural and economic attributes of farming systems, some recent methodological contributions have leaned towards systematic applications of ecological concepts to geographical study (Stoddart, 1965: 242-251; Stoddart, 1967: 511-548; Harris, 1969a: 133-142).[7] In this thesis the ecological approach will be regarded as of essential importance in illustrating the relationships between the given environment and the specific technology developed in a farming system. Within any farming system, farming technology is not only one of the major economic variables (together with land and labour), but is also the most significant ecological variable especially as regards the exploitation and modification of the given environment. In this connection, as Harris suggests, the ecological approach "applies equally to techniques of cultivation and harvesting as to crops and livestock: all may be regarded as components of given ecosystems" (Harris, 1969b: 3).

It is one of the advantages of this approach that it can provide a perspective for comparative analysis of farming systems by comparing peasant adaptative patterns to different ecological conditions through different technologies. The value of this kind of approach is apparent in Blaut's attempt to compare peasant small-scale and plantation farming systems. He develops two analytical concepts: resource material and resource-process in resource utilisation, and applies these concepts by focusing special attention on peasant behaviour patterns (such as the peasant's perception of resources) and value judgments in the two farming systems (Blaut, 1961: 47-67). His exploration into peasant

behavioural aspects in farming operations should be evaluated in relation to the criticism of the static norms of ecological frameworks.[8] In this context Harold Brookfield's emphasis on 'the perceived environment' is also a significant contribution to our understanding of how peasant perception and decision-making form essential elements within a man-environment system. (Brookfield, 1969: 53-80).

Whilst these efforts represent the research undertaken by agricultural geographers, the major theoretical contributions of the ecological approach in application to the study of farming systems have been developed mainly in cultural ecology by American anthropologists.[9] The method of cultural ecology developed by Julian Steward is the earliest and the most systematic application of ecological concepts to a wide range of cultural and environmental conditions in subsistence activities (Steward, 1937: 87-104; Steward, 1955: 30-42). According to Steward's methodological framework the fundamental procedures of cultural ecology are as follows:

(1) The analysis of the interrelationship of exploitative or productive technology and environment.

(2) The analysis of the behaviour patterns involved in the exploitation of a particular area by means of a particular technology.

(3) The holistic approach to ascertain the extent to which the behaviour patterns entailed in exploiting the environment affect other aspects of culture (Steward, 1955: 40-42).

As regards the present study, the first procedure is the most crucial one, and will be fully discussed with special reference to the relationships between physiographical and hydrological conditions and a series of rice-growing techniques and methods of water control in

each farming system. The second procedure is closely associated with the economic analysis which forms part of agricultural geography. In this study, however, the analysis of behaviour patterns is chiefly focused upon the aspects closely related to the major production factors, i.e., technology, land and labour.

The third procedure, the final task of cultural ecology, does not seem to be directly relevant to the present study. Steward has certainly delimited the application of his holistic approach to a 'cultural core': the constellation of features which are most closely related to subsistence activities and economic arrangements (Steward, 1955: 37). His 'cultural core', however, is not necessarily obvious in reality, and, as Marvin Mikesell points out, may be a hazardous proposition beyond a certain point (Mikesell, 1967: 629). Be that as it may, it can be considered that the paradigm of cultural ecology linking the environment to socio-economic conditions with technology as the central analytical concept, certainly contributes in clarifying a substantial part of the attributes in a farming system.[10]

Another theoretical contribution to the ecological approach has been made by Harold Conklin in his 'ethnoecological' studies of shifting cultivation (Conklin, 1954: 133-142; Conklin, 1957). Conklin's ethnoecological studies, though not directly influenced by Steward's cultural ecology, nevertheless succeed in indicating the major characteristics and rationality of Hanunoo shifting cultivation, emphasising the native concept of ecology in swidden farming. His methodological stress is laid on the analysis of "not only the local environmental conditions and their apparent modification, but especially the determination of how these conditions and modifications are culturally interpreted" (Conklin, 1954: 133-134). This methodology,

applied in the study of a specific agricultural system, is very close to the fundamental goal of ethnography that aims to describe the culturally significant arrangements derived not from previously designed logic, but from locally recognised categories and contexts (Conklin, 1964: 25-26). Thus, the 'ethnoecological' method enables us to gain a perspective towards the cognitive analysis of socio-cultural attributes in a given farming system.[11] This methodology is successfully developed in a highly suggestive and stimulating study by Michael Moerman on agricultural change in the northern Thai farming system of rice cultivation, a study which will be referred to below. (Moerman, 1968).

An enormously significant contribution in cultural ecology is the work of Clifford Geertz on ecological change in Indonesia in relation to two contrasting agricultural systems: shifting cultivation and wet-rice cultivation, these being traditionally practised in outer and inner Indonesia respectively (Geertz, 1963). By contrast with Steward, Geertz initially attempts to apply the ecosystem concept enunciated by Eugene Odum, in order to comprehend the farming system as the interdependence of culture and physical factors. Here, the farming system is regarded as "an ecosystem within which certain selected cultural, biological, and physical variables are determinately interrelated" (Geertz, 1963: 9). In Steward's cultural ecology there is a rather typological concept in which the mechanisms of interaction between natural environment and socio-cultural attributes are overlooked in subsistence activities. His major concern is to examine "whether similar adjustments occur in similar environments" (Steward, 1955: 42).[12] Although this typological framework is accepted to some extent, Geertz's main concern shifts from the typology of farming systems to more incisive queries: organisation, mechanisms, stability, development and decline of an ecosystem, and

comparison in these matters with other such systems (Geertz, 1963: 10). Geertz examines these aspects with respect to two ecosystems: shifting cultivation and wet-rice cultivation, but his work mainly concentrates on the historical process of the socio-economic conditions of rice cultivation in the context of colonialism. Thus, he successfully shows an 'agricultural involution' as the ultimately self-defeating process of the wet-rice cultivation in Java under colonial regimes. This is mainly caused in an ecological sense by the 'involuted' mode of cultivation specified in the wet-rice ecosystem "with its extraordinary ability to maintain levels of marginal labour productivity by always managing to work one more man in without a serious fall in per-capita income" (Geertz, 1963: 80).[13]

The ecosystem approach by which Geertz succeeds in describing the historical process of socio-economic change in farming systems has also been adopted in many cultural ecological studies.[14] For example, Eric Wolf, in indicating the economic attributes of peasant society, distinguishes two agricultural ecosystems: the paleotechnic ecotype which represents traditional agriculture employing human and animal labour, and the neotechnic ecotype which relies on the energy supplied by combustible fuels and modern techniques (Wolf, 1966: 19). Robert Netting's detailed study on Kofyar agricultural ecology shows the functional relation of intensive field-crop farming to social organisations in northern Nigeria. His research is more sharply focused upon the substantial analysis of relationships between technology and physical environment rather than Steward's inclination towards holistic cultural analysis (Netting, 1968; Netting, 1969: 102-112).

Among numerous studies in cultural ecology Lucien Hanks' work on the adaptation processes of various farming systems of rice cultivation

in the Chao Phraya delta is also of relevance to this study in terms of both regional focus and methodology. Hanks mainly deals with three distinctive farming systems: shifting, broadcasting and transplanting modes of cultivation in the context of peasant adaptation to the changing environment of Bang Chan,[15] a village in the delta (Hanks, 1972: 69-147). In order to formalise the distinctive features of the three ecosystems,he attempts to compare input and output as quantitative data of energy exchange in each ecosystem. Dealing with the available data in the various farming systems,this method successfully shows the degrees of labour intensity and productivity in each ecosystem, and suggests, to some extent, how the Bang Chan peasant farmers have culturally adapted to such changing processes of farming ecosystems.

In the course of analysis Hanks gives particular emphasis to the critical ecological concept, 'the holding' (Hanks, 1972: 44-47). A 'holding', differing from a niche, seems to indicate the total of active working relationships in the production process, contrasting with "the natural succession that would return the area step by step to savannah or forest" (Hanks, 1972: 45).. Since the energy exchange works between a given social group and its environmental 'holding', it can be quantitatively measured by "the inputs and outputs of various holdings on the basis of man-days of work and the resulting tons of provender" (Hanks, 1972: 47). In this way human energy requirements for each mode of cultivation can be shown in aggregate form: i.e., yields of rice, labour requirements per unit of land, manpower requirements in both direct and indirect forms, and the relationship of input to output, etc. This is undoubtedly quite useful in comparisons of societal quantum of energy in the mode of cultivation. These aggregate figures, however, hardly suggest the functional relationships

of economic elements in various 'holdings'. What should be revealed in a comparison of farming systems is the extent to which land, labour and technology or capital are interrelated, and which element performs a more significant role in the course of production. Although Hanks' critical concept of 'holding' should be properly evaluated, the present study is more concerned with the relationships of the elements in various active 'holdings'.

3. Problems of Cultural Ecological Approach

In this study of farming systems the ecological approach is generally applicable and seems to provide a research tool of considerable analytical power. In particular, it not only provides typological distinction of farming systems in terms of techno-environmental setting, but it also enables us to compare various farming systems by examining the structural relationships of environmental and socio-economic variables in each farming system. As regards the cultural ecological approach, however, some theoretical issues should be examined in relation to the socio-economic aspects of agriculture.

Those studies in cultural ecology which have focused on the relationship between technology and environment have been criticised by scholars whose objective is the pursuit of a cultural ecology more relevant to policy issues. The most explicit criticism of the ecosystem approach and of Stewardian cultural ecology has been made by John Bennett (Bennett, 1973; Bennett, 1976: 164-167, 220-224). Emphasising adaptive dynamics, Bennett argues that existing ecological approaches have not succeeded in verifying behavioural processes involving decision-making and choice in production processes (Bennett, 1976: 166). According to Bennett, ecosystem analysis is appropriate and meaningful only in the

treatment of agricultural systems as physical systems, so that "the heart of an ecological inquiry involving complex human events and actions" should be basically a sociological analysis (Bennett, 1976: 99).

Much the same criticism of ecosystem analysis has been made by some 'ethnoecologists' whose concern is to ethnographically describe cultural behaviour and cognitive systems in a particular society (Frake, 1962: 53-54; Johnson 1974: 87-88). Relevant suggestions regarding adaptive dynamics have come from Moerman who has laid great stress upon peasant perception and decision-making in terms of local cognition within a given farming system. Moerman's major concern is not so much with the ecosystem itself, but more with a sociological explanation of the peasants' economic activities following the introduction of tractor ploughing. He declares that one of his major tasks as an anthropologist in the study of the changing process of a farming system is "to translate the abstract (and covertly ethnocentric) formulations of the economist and policy maker into locally appropriate categories and activities" (Moerman, 1968: 83).

The problems of adaptive dynamics involving peasants' decision-making and choice have recently been discussed in relation to the question of economic development in various disciplines, for example: Norman Long in sociology, Joel Migdal and James Scott in political science, and Sutti Ortiz and Michael Calavan in economic anthropology (Long, 1977: 105-143; Migdal, 1974: 112-129; Scott, 1976: 13-55; Ortiz, 1967: 191-228; Ortiz, 1973; Calavan, 1977).[16] This has been also one of the main themes in agricultural geography, since decisions and choices made at the farm level, which is the fundamental unit of production and distribution, are closely related to the arrangement and allocation of resources such as technique, land and labour, and

consequently those decisions are reflected in land-use patterns (Morgan and Munton, 1971: 29). The peasant decisions, however, can also be dealt with not as a result of adaptation but as a process of adaptation in the context of an ecological approach. A series of interrelated decisions made throughout production processes is farming technology itself, by which a peasant utilises productive resources toward his goal. If technology means such a broader behavioural and socio-economic concept as examined later, peasant decisions in various stages of farming can be regarded as the most subjective and dynamic aspect in the techno-environmental context of a farming system. It can be considered, therefore, that the technological analysis of farming systems must comprehend such dynamic aspects of peasant adaptation to the given environment, taking into account the peasant's perception and cognition.

A further problem is the extent to which the ecological approach is relevant to socio-economic aspects of farming systems. The establishment of a farming system relates not to all elements of the natural environment, but only to certain specific elements. It can be argued that a particular farming system represents peasant adaptation, via technology, to only those environmental elements which are of relevance to agriculture. The study of farming systems, therefore, must be concentrated on such particular elements, which are called 'the effective environment' (Netting, 1965: 82), or 'the relevant environmental features' (Steward, 1955: 40). At the same time, ecological enquiry cannot necessarily extend to the whole aspect of culture and society, but is more effective in application to the relatively confined domain of peasant activities. As Geertz points out, the ecological approach "forms an explicitly delimited field of inquiry, not a comprehensive master science" (Geertz, 1963: 10).

This restriction in its application to social and cultural aspects has been stressed by many scholars, and is apparent in the 'cultural core' of Steward, and in the 'ecologically adaptive social instrumentalities' of Netting (Steward, 1955: 37; Netting, 1965: 86).[17]

The socio-economic dimension of farming systems is included within the field of agricultural geography. Especially in rice cultivation, patterns of land tenure and labour utilisation are crucial aspects of production in relation to the techno-environmental context. The present characteristics of the land tenure pattern, such as size of holding, accumulation of holding and landlord-tenant relationships, are the results of a long history of peasant exploitation of a particular physical environment. A pattern of labour allocation and mobilisation determined by the circumstances of the domestic labour force and the availability of co-operative and wage labour, is also linked with the particular technology employed in, and related to, the environment. Thus, the theoretical framework of cultural ecology is relevant to the study of the socio-economic dimension of peasant farming.

The third problem which should be noted here relates to the recently growing criticism of the static equilibrium model which has dominated the ecological approach represented by 'neo-functionalism'. Roy Rappaport's study of Tsembaga Maring in the New Guinea Highlands shows homeostasis of the ecological system in which ritual pig slaughter and feasts regulate growth of the pig population, and control increasing demands upon human labour and fodder production (Rappaport, 1968: 224-242). In his homeostatic ecosystem only the ritual pig feasts can function to regulate the interrelationships between environmental and social factors. The ritual pig feast is the sole variable which operates a negative feedback mechanism to stabilize the whole process of production.

The 'neo-functionalism' represented by Rappaport's study views the ecosystem as closed, and holds that persisting homeostasis is sustained by a negative feedback mechanism. This approach tends to overlook socio-economic factors which could emerge to interrupt such static equilibrium.[18] Attacking this tendency of neo-functionalism towards a new kind of environmentalism, Jonathan Freedman produces highly plausible arguments: "The systems approach has provided ecologists with an awareness of the limits imposed on variables by other variables and, hopefully, the possibility of contradictions between elements or subsystems. But they have assumed that if the system exists it must be because the limiting variables maintain it at a viable operational level" (Freedman, 1974: 465). Freedman's clear-cut criticism of the ecological approach derived from the simplistic extension of biological ecology has led to a number of discussions on theoretical frameworks dealing with social change and contradiction in equilibrium (Ellen, 1978: 295-300; Brown, 1979: 235-251; Burnham, 1973: 93-102; Burnham, 1979: 185-202; Clarke, 1977: 377-383).

However useful it may be in elucidating the shifting cultivation of the New Guinea Highlands, naive ecological functionalism will not serve to interpret peasant farming systems of rice cultivation, for rice cultivation is marked by complexity of production process and by involvement in wider socio-economic contexts, including the national economy. As already mentioned, a particular technology adopted in a farming system interacts with the entire process of rice production, in particular, with the land tenure situation and labour utilisation. In this framework a farming system can be perceived as an ecologically interrelated system. Although technology is a central analytic tool in this study, it does not necessarily mean that technology is the sole

variable or that it functions as the prime determinant of the all round characteristics of production processes. Instead, land and labour are always major variables together with technology or capital, both in theoretical and empirical terms, in rice cultivation throughout South East Asia (Fuhs and Vingerhoets, 1972: 25). Moreover, land tenure problems and the emergence of numerous landless rural labourers (features which have recently become common in Thailand) cannot simply be attributed to the technological differences between farming systems. These problems which lie beyond the limits of an explanatory ecological model require further consideration in the socio-economic context. Farming systems essentially consisting of both ecological and socio-economic relations can only be effectively explored through investigations not only of physical and technical aspects but also of other aspects observable by way of empirical field studies.

4. Peasant Agriculture of Rice Cultivation

The study of the farming system in agricultural geography, as already mentioned, deals with the socio-economic aspects of production and distribution as well as the technological aspects, in terms of ecological relationship. Socio-economic and cultural attributes of agrarian populations have been generally characterised by the concept of peasant agriculture and peasant economy in various disciplines. A number of attempts have been made to define and describe distinctive characteristics of peasantry, mostly by American anthropologists and in geography by Harvey Franklin (Redfield, 1956; Wolf, 1955; Wolf, 1966; Wolf, 1969; Foster, 1967; Geertz, 1962; Franklin, 1962; Franklin, 1965; Franklin, 1969). The earlier attempts of Redfield were mainly intended to place the peasant society as something intermediate between

the tribal and the modern industrial societies in an evolutionary context (Redfield, 1956: 23). It has been stated that a peasant society always forms a 'part society' within a larger system (Kroeber, 1948: 284; Redfield, 1956: 40).

The early attempts, which are rather unclear when trying to distinguish peasantry from other categories, are elaborated by Eric Wolf, who emphasises the particular type of peasant economy and its relationships to external power. In relation to the economic aspects of peasantry he stresses at least two points: the first is that peasant farming is not an enterprise, and the peasant runs a household, not a business concern; the second is that the surplus of peasant cultivation is always transferred to a dominant group of rulers; "so far, then, the term 'peasant' denotes no more than an asymmetrical relationship between producers of surpluses and controllers" (Wolf, 1966: 2,10). The second framework based on the structured relationship between the peasant and world markets has already been suggested in his earlier attempt to establish typologies of Latin American peasantry, in which ecological setting and adaptive technology also seem to be considered (Wolf, 1955: 453-454). Although these specific cultural anthropological studies of peasantry, especially Wolf's contributions, are of value in relation to the present analysis, it is also necessary to examine the general characteristics of peasant agriculture and its economy.

Based on empirical data from Polynesian and South East Asian peasant societies, Raymond Firth is specifically concerned with the various types of peasant economies in relation to social structure. Taking the term peasant primarily as an economic reference, Firth defines the general nature of peasant economy as follows:

> "By a peasant economy one means a system of small-scale producers, with a simple technology and equipment, often relying primarily for their subsistence on what they themselves produce. The primary means of livelihood of the peasant is cultivation of the soil" (Firth, 1951: 87).

Firth sees the peasant economy in terms of its relationships to particular types of social structure rather than in terms of the means of production or technology employed, and for this reason, the term peasant as used by him does not merely indicate agricultural cultivators but also is extended to cover other types of small-scale producers, such as fishermen or rural craftsmen (Firth, 1951: 87; Firth, 1950: 503).[19] However, he clearly recognises a significant difference between the agriculturalists and the others in the social framework as regards the use of peasants' assets, in particular land and labour. Patterns of land allocation and labour utilisation in the production process are closely determined by elements of the social structure such as ties of neighbourhood, family and household, kinship, and status and class differences. In the distribution process, social strata such as rulers, chiefs and other people of high status affect the product allocation in a peasant society, while ceremonial and ritual institutions are often closely related to the social characters of consumption patterns (Firth, 1969: 27-35).

Such considerable influence of social framework upon the peasant economy has been emphasised and described by many economic anthropologists who have conducted field research in specific village communities. For example, Maning Nash stresses that:

> "What is distinctive about peasant and primitive societies are not the habits

> of mind about advantage, nor an inability to calculate costs and benefits of a course of action, nor even an absence of a motive of gain; but rather the possession of a set of concrete social organizations which directly channel economic choice, on the one hand, and a set of sanctions which operate to keep economic deviants in physical as well as moral jeopardy on the other".
> (Nash, 1961: 186).

These distinctive characters of social organisation discovered in numerous empirical studies have led to current tendencies to establish a more specific model of peasant economy or mode of production. One of these trends is most explicitly expressed by George Dalton and Marshal Sahlins. Emphasising the criterion of importance of market exchange transactions, Dalton distinguishes traditional peasantries with their petty or peripheral market economy, from those with a marketless subsistence economy (e.g. tribal societies) and industrial societies where the economy is market-integrated (Dalton, 1971a: 173-177; Dalton, 1971b: 13). And what Sahlins calls the domestic mode of production is concerned with a broader category of specific economy appropriate to most of the tribal and peasant societies as distinguished from the capitalist mode of production (Sahlins, 1974: 41-100).

Another theoretical framework in which the peasant economy is viewed as a conceptual mode of production has been provided by the Russian economist, A.V. Chayanov and his successors. Chayanov, who is particularly concerned with the patterns of peasant economic behaviour at the level of the individual family farm, points out that the peasant family primarily aims at securing its subsistence needs rather than making a profit, and for this reason, the motivations of the peasant are quite different from those of the capitalist (Chayanov, 1966: 1-5;

Kerblay, 1971: 150-151; Thorner, 1968: 507). This view, contrasting with the orthodox Marxist-Leninist theory, leads towards the identification of a specific mode of production applicable to peasant economies, a mode which differs from petty commodity production as a formative stage of capitalism (Chayanov, 1966: 235-240). Chayanov's attempt has been adopted and evaluated by some western and Japanese scholars,[20] especially by Daniel Thorner who suggests the existence of the peasant mode of production at the macro-level of economy in the context of economic history (Thorner, 1971: 202-205; Thorner, 1968: 507-508). It should be noticed, however, as reflected in the heated arguments among Marxists,[21] that the attempts to treat peasant economic activities as a specific mode or socio-economic system comparable to feudalism and capitalism is not universally accepted in agricultural geography, nor in economic anthropology.

Apart from the debate as to whether or not a peasant or peasantry exists as a mode of production, it is quite useful for further discussion to assume that specific types of economy associated with peasant societies differ considerably and in many respects from those associated with tribal people or with modern industrial society. For the purpose of socio-economic analysis of peasant agriculture as an empirical study,it is necessary to examine the general characteristics of peasantry. The recent attempt of Teodor Shanin is quite suggestive for an analysis of socio-economic aspects of peasant agriculture. He delimits peasant societies by establishing a general type with four basic facets as follows:

(1) The peasant family-farm as the basic unit of multi-dimensional social organisation.

(2) Land husbandry as the main means of livelihood directly providing the major part of the consumption needs.

(3) Specific traditional culture related to the way of life of small communities.

(4) The 'underdog' position. The domination of peasantry by outsiders (Shanin, 1971a: 294-296).

All these aspects seem to be applicable and crucial in an analysis of the peasant agriculture of South East Asia, especially at village level. The second aspect is directly related to the main theme of this study, which has already been discussed in relation to ecological and technological contexts. The first facet dealing with the peasant household as the basic unit of organisation both in production and distribution processes, has been often pointed out elsewhere by many scholars, and is universally justified in the peasant agriculture of rice cultivation in South East Asia. Nash explicitly indicates that in peasant economies "the social units involved in production and consumption are households, not in combination. The economy is household-organised" (Nash, 1966: 40). In European peasantries, Boguslaw Galeski thoroughly stresses the family-farm analysis in his Polish peasant studies, while Rodney Hilton and Alan Macfarlane, who are deeply concerned with the peasant society in medieval England, suggest that peasant holdings were essentially worked as a family unit, primarily with family labour (Galeski, 1972: 10-13; Hilton, 1975: 13; Macfarlane, 1978: 14-16).

In South East Asia, especially in Thailand, most empirical field studies have been chiefly concerned with the peasant household economy in terms of rice production and have not always grasped the basic importance of the family farm in cross-cultural and historical perspectives.[22] Extensive socio-economic surveys focused on household

economy in Thailand seem to have begun with Karl Zimmerman's pioneer study in various provinces in the 1930's (Zimmerman, 1931).[23] In recent years, some systematic socio-economic surveys covering various levels of study area from several provinces to specific villages provide detailed data of household economy in both production and consumption processes (Uthit, 1958; Chaiyong, 1965; Fuhs and Vingerhoets, 1972; Ng, 1973: 173-186; Dixon, 1974; Demaine, 1977; Amyot, 1976; SOAS, 1978; Fuhs, 1979).

As many studies indicate, one of the most notable aspects of the Thai peasant household economy is the function of family in relation to land ownership and labour utilisation (Kamol, 1955: 35-41; Mizuno, 1968: 842-852). Family types of rice-growing peasant reflect, to some extent, the present pattern of land ownership, and the developing cycle of the family is closely related to acquisition of land properties through inheritance.[24] Labour requirement in the course of rice production basically depends on domestic labour, though supplemented by co-operative labour and wage labour.

Shanin's third analytic concept is associated with the peasant cultural patterns typical of a small village community, covering a wide range of sociological aspects from economic co-operation to a peasant world view. The present thesis, however, is mainly confined to social organisations primarily effective in the production of rice cultivation, and by which "peasants reach levels of self-sufficiency unobtainable in the individual household" (Shanin, 1971a, 295). The fourth concept, which has already been developed by Wolf in his earlier work, reveals the specific situation of the peasant in the context of the political economy, emphasising expropriation of surpluses by powerful outsiders and political and cultural subordination. Although such an aspect of peasantry in the political economy is undoubtedly significant in a wider setting,

it is not fully discussed in this study, but will be taken into account in the course of discussion on the changing aspects brought about in farming technology and patterns of land tenure and labour utilisation.

Thus, the theoretical discussions on peasant categorization, and especially Shanin's generalised facets, provide at least the major analytical frameworks for socio-economic consideration of farming systems, the level of the household and of the village community. Analysis at this level together with regional examination is essential in any study of peasant farming, enabling us to approach the most detailed data on productive factors and functions of technology, and helping to show how they are integrated into a farming system. A peasant farming system once viewed from the ecological relationship between environment and technology, must be examined in the socio-economic context of production which could be most explicitly revealed in the framework of family farm and village community.

Another relevant concept, often referred to in studies of the peasant farming of South East Asia, is the dichotomy between subsistence and petty commodity production. What is meant by the terms 'subsistence production' and 'petty commodity production' seems to vary widely according to the researcher and the field.[25] Conventional criteria to distinguish the two categories refer to the proportion of production sold in the total peasant production, the ratio of purchased factor inputs and the degree of hiring of wage labour to total labour input in the production process, as well as taking into account the level of farming techniques used and the characteristics of peasant decision making (Wharton, 1969: 15-16). Having examined these criteria, one might define subsistence production as an agricultural sector made up of those peasants whose major goal of production is for family food

consumption rather than for commercial sale. Likewise, petty commodity production, often called small-scale commercial agriculture, indicates a sector in which peasants primarily assign their productive resources to commercial disposal of their products rather than to family consumption (Wharton, 1963: 47-50; Wharton, 1969: 14, 18). Since such dichotomous categories are basically set up as ideal types, the reality of peasant farming undoubtedly varies geographically and socially between the extreme types. This leads some scholars to claim that the concepts of subsistence and commercial production are necessarily one dynamic whole so that they should be in a continuum or succession of stages (Hodder, 1968: 102).

This kind of conceptual framework dealing with subsistence and commercial production might be useful as an indicator by showing quantitative measures for the degree of the orientation towards subsistence or commercial production in particular empirical cases. However, it tends to be misleading in failing to detect fundamental differences between the two forms of peasant production, which have been historically generated within peasant farming systems. The differences underlying the concepts of subsistence and petty commodity production are in kind rather than in degree. There are fundamental conditions of production process in establishing the two forms, which may have an effect upon the conventional criteria often employed.

First, the concept of subsistence production denotes peasant farming primarily devoted to producing use values, not only in securing staple crops for domestic consumption but in utilisation of productive resources for maintaining daily life in general. Although this form of peasant production may be involved in exchange of surplus products

through localised markets, commodity relations do not penetrate deeply enough to destroy the overall structure. Second, the concept of petty commodity production is here taken as a form of production in which peasants produce primarily agricultural products as commodities, and in many cases, at the same time have to produce use values for their own consumption. This form of peasant production has been established, in many South East Asian countries, after the destruction of the preceding subsistence production under the wide prevalence of commodity relations or, in other words, relations of the money economy. Third, both forms of peasant production remain within the framework of peasant agriculture which we have seen earlier. It should be particularly noted that even in petty commodity production the peasant producer is basically neither a capitalistic entrepreneur nor a proletarian, with little separation of him from the means of production such as land and tools (Bernstein, 1977: 61).

These distinctive forms of peasant production conceptualised at an abstract level should be considered in the South East Asian context with special reference to Thailand. Generally speaking, the form of subsistence production has persisted among peasants living over wide areas within South East Asia. Such areas within Thailand lie to the North-East, South, marginal areas of the Central region and the North, on the latter of which our discussion will be focused later. Although there are regional and intra-regional variations in the proportion of production sold to total production and in the degree of penetration of money economy, the basic conditions of subsistence rice production emphasising use values have been consistently retained in these areas. Even though cash crop production has recently increased to some extent, the basic situation is thought to have remained unchanged.

On the other hand in the South East Asian context, petty commodity production was established in particular areas with the advent of colonialism and within the framework of the colonial economy, notably in the nineteenth century. In Thailand, it was established along with the growth of rice-export agriculture in the Chao Phraya delta of the Central region from the late nineteenth century. The emergence and subsequent growth of rice-export agriculture was not a simple extension of an indigenous development of the subsistence production existing in the area, but a result of the external impact of colonial powers, despite the fact that Thailand maintained political independence. What the peasant farming in the delta has experienced during the past hundred years is fundamentally different from the experience of peasants who are still familiar with subsistence production.[26] In his analysis of peasant export agriculture, Hla Myint puts forward two stages of peasant economy in terms of the growth of commodity relations; in the first stage, export production is a spare-time activity supplementary to subsistence production; but in the second stage peasant households begin to devote the whole of their available resources to export production and there is an increasing demand for cash for locally produced foodstuffs and moreover imported manufactured goods (Myint, 1973: 33-38). The peasant petty commodity production centred around the Chao Phraya delta clearly belongs to Myint's second stage, while the first stage may be found in certain advanced areas within the subsistence sector.

The relationship between subsistence production and petty commodity production might be a dynamic one as B.W. Hodder suggests (Hodder, 1968: 102), but it is not simply a sort of continuum, but involves fundamental changes brought about in economic, social and cultural aspects of peasant farming. As we have pointed out in defining

the forms of peasant production, the extremely specialised petty commodity production of rice for export in the Chao Phraya delta has been achieved only through the destruction of various agricultural and non-agricultural activities to produce use values necessary for maintaining peasant self-sufficiency. The withdrawal of labour from use-value production has led to the erosion of an entire culture of peasant production (Bernstein, 1977: 62). In the delta, local industries such as tool-making, textiles and sugar refining, have completely declined, having been replaced mainly by imported commodities since the late nineteenth century (van der Heide, 1906: 74-101).[27] More recently we can also see this tendency in the marked decline in the rearing of buffaloes, which have long provided the motive power in land preparation and many other farming operations in the delta. This process of destruction has been completed not through local specialisation but through close linkage with the metropolitan capitalist economy, producing rice production for export and becoming markets for colonial imports (Alavi, 1981: 14). In this way, the petty commodity production in the delta, being deeply involved in the market relations, has broken down the totality of self-sufficiency in subsistence production.

Unlike subsistence production where a non-monetary basis has still largely survived in the production process and in exchange, the petty commodity producers have become involved totally in commodity relations. These peasant households are nowadays scarcely capable of the production of export rice as a commodity nor of home consumption rice without considerable cash expenditure in the production process such as for mechanised ploughing, hiring wage labour and industrial inputs, in addition to other domestic consumption considered necessary to maintain their daily life. The necessary expenditure together with heavy monetary obligations

in the form of debts and land rent etc. increasingly makes their commodity production an economic necessity; they can no longer afford to retreat from it (Myint, 1973: 37; Bernstein, 1977: 63). Once the market relations have destroyed the conditions of subsistence production, peasant farming has to be internally restructured within the circuit of commodities linked with the metropolitan capitalist economy.

5. Technology: Its Relevance to Peasant Farming

As already mentioned there is little doubt that the relationship between environment and technology is one of the essential subjects in studies of any farming systems. The term technology, generally embracing the means by which the peasant controls and modifies his physical environment, is a crucial factor together with more economic factors such as land, labour and capital (Spier, 1968: 131-132; Merrill, 1968: 576-577). In traditional agriculture, technology can be used comprehensively to represent all procedures for utilising resources and the productive equipment involved, and is often regarded as non-land capital in economic and economic anthropological terms (Firth, 1964: 18-19; Mellor, 1966: 192-194).[28] As suggested by the terms 'farming method' or 'exploitative technology', technology in agriculture has chiefly referred to such procedures and tools used in the course of production (Whittlesey, 1936: 210; Steward, 1955: 40; Boserup, 1965: 24-27; Farmer, 1968: 202). Such a concept of technology would undoubtedly be advantageous in devising a typology of farming systems by showing the distinctive characteristics of a series of farming operations and equipment used. But technology, when confined to procedure and material conditions, nevertheless sometimes fails to

show the adaptive dynamics and social relations of peasants in modifying and manipulating their physical environment and mobilising their own labour force.

Thus, we need to take into consideration peasant cultural and behavioural response to physical environment and socio-economic conditions. As has been suggested by Daryll Forde, a broader concept of technology should include what he calls 'a cultural pattern': "Between the physical environment and human activity there is always a middle term, a collection of specific objectives and values, a body of knowledge and belief" (Forde, 1949: 463). Forde later developed this idea in order to elucidate the relationship between bio-physical conditions and institutionalised modes of social organisation in his 'socio-cultural ecology' (Forde, 1970: 19, 26). Robert Netting and Stephen Gudeman who successfully describe subsistence technologies of farming systems in Nigeria and Panama respectively, also develop such a broader concept of technology in their analyses of peasant adaptive dynamics (Netting, 1965: 85-86; Netting, 1968: 16; Gudeman, 1978: 61).

Michael Moerman attempted to further develop the concept of technology as an analytic category that perceives peasant activities as solutions to problems. Following Clellan Ford's view of patterned behaviour as problem solving (Ford, 1942: 555-557), his study of Thai farming technology is focused upon "the ways in which the farmers of Ban Ping make use of what we call things, people, and ideas in order to solve the problem of growing rice, as they see it" (Moerman, 1968: 26). In this way, technological analysis will lead to a proper understanding that a long-established farming system is the result of quite rational decisions and has reached a high degree of efficiency using relatively simple tools and techniques. Thus, the study of technology enables us

not only to show typological comparison of material conditions and farming methods but also to elucidate behavioural aspects of adaptation to the given environment.

However, the broader concept of technology postulated by these scholars seems to be confined to cultural and behavioural aspects rather extending their idea toward social and economic relations involved in the production process. The other conceptual framework of technology worth noting in a study of peasant farming comes from sociological studies inspired in a Marxian context (Marcuse, 1941: 414-415; Lukács, 1966: 29-31; Habermas, 1971: 94-95; Dickson, 1974: 10-11, 16-17).[29] Like the cultural formulation of the concept of technology, most of these works go beyond the conventional comprehension of technology within the context of technique and procedure. In addition to this, they claim that the technology is taken as a social and economic process, emphasising the relations between technical apparatus and a society (Marcuse, 1941: 414; Dickson, 1974: 16). For Herbert Marcuse, technology as a totality of technical apparatus and its operation in production, is at the same time a form of organising and perpetuating (or changing) social relations of production and a manifestation of prevalent thought and behavioural patterns (Marcuse, 1941: 414). There is little doubt that this conception of technology is primarily directed toward the critical analysis of modern techniques and their social implications in the developed capitalist societies. Nevertheless, it appears basically to be appropriate for dealing with the broader dimension of peasant technology, providing analytic power to tackle social and economic relations among peasants involved in farming, which remain obscure in the cultural and behavioural conceptions of technology.

With the above brief examination of the concept of technology, we can here define the concept to be used in the present study in the context of peasant rice farming. Given the term 'technique', indicating tools, equipment and their usage in response to physical environment, 'technology' will be defined as a broader concept embracing 'technique' necessary for rice farming, its behavioural aspects such as knowledge, information, ritual and decisions concerning production, and the relations of these aspects to the socio-economic conditions in which peasant farming is carried out. Technology represents therefore a complex of relationships between material, behavioural and socio-economic conditions in the production process, rather than individual elements such as ploughing, decision on selection of seed varieties, and mobilisation of necessary labour. This is even more obvious when we take an example in irrigation. A physical system of small-scale irrigation consisting of a weir and canal networks may be a technical apparatus, or, as it is often called, a means of production, constituting a part of peasant technology. To work the physical system efficiently there may be certain requirements for its operation and maintenance. In order to fulfil such requirements, a social organisation for controlling the system may be established under complicated customary regulations and a highly co-operative social norm. In this way, all techniques and their operation in peasant farming always embody behavioural and socio-economic relations. Thus the technology as an analytic concept of relationships is taken in this study to tackle farming systems consisting of both ecological and socio-economic contexts.

However, there have been a number of studies relevant to the farming technology of rice cultivation in South East and East Asia, although in many cases they confine themselves to techniques and

procedures, in the agricultural sciences, geography and anthropology. The classical works of D.H. Grist and Takane Matsuo provide basic agronomical accounts of rice-growing, and Tadayo Watabe's agronomical study on glutinous rice in northern Thailand is quite useful in dealing with the detailed farming data of this region (Grist, 1975; Matsuo, 1954; Matsuo, 1961; Watabe, 1967).

Contributions from French geographers are also notable, and include detailed accounts of the farming technique of rice cultivation in Vietnam and Cambodia (Gourou, 1945; Delvert, 1961: 323-370). Karl Pelzer's studies suggest a general distinction of technique between shifting cultivation and sedentary rice cultivation in South East Asia (Pelzer, 1945: 3-78; Pelzer, 1958: 124-143). Agronomical studies of farming techniques which more systematically cover wider areas have been carried out by Hans Ruthenberg, and in Indonesia by G.J.A. Terra (Ruthenberg, 1976: 163-230; Terra, 1958: 157-182). Inez Adams' extensive survey of farming techniques in relation to 'wet' and 'dry' rice cultivation is an early example of anthropological study (Adams, 1948: 256-282).

With respect to Thailand, several geographical and economic studies referring to Thai rice cultivation have suggested considerable differences in natural environment and socio-economic conditions within the Chao Phraya water system, the major rice-growing area in the country (Graham, 1924: Vol. 2; Thailand-Ministry of Commerce and Communications, 1930; Wongsanupraphat, 1945; Zimmerman, 1931; Fisher, 1965; Silcock, 1970). Some agricultural geographers and agronomists also have dealt with farming techniques and their socio-economic implications (Credner, 1935; Pendleton, 1962: 159-166; Barton, 1960: 153-164; Barton, 1963: 414-418; Watabe, 1964: 25-42; Iwata, 1963: 22-38). One of the most

distinguished works on the Chao Phraya delta region is that of the Thai ethnologist, Phya Anuman Radjadhon in the 1940's (Anuman, 1965: 129-194).[30] Anuman's classic work, though weak as regards critical examination of the data obtained, successfully provides a vivid description of farming procedures and material culture together with peasant rural life in this delta.

Many of these works are devoted to a general description of farming technique, based on extensive surveys, and for this reason, they are lacking in analysis of the village context and are unable to clearly reveal peasant adaptive dynamics through the technology involved. Despite the numerous detailed village studies that have been conducted since Cornell's Thai project began in 1948, only a few are seriously concerned with farming technology in terms of ecological relationships. Relevant research of this kind has been undertaken in Bang Chan, a Cornell project village in the Chao Phraya delta by Kamol Janlekha and Lucien Hanks, and in Ban Ping in the northern intermontane basin by Moerman (Kamol, 1955; Hanks, 1972; Moerman, 1968). Dealing with the existing technology, these studies, especially the latter two, are deeply concerned with technological change which urges peasant farmers to make decisions related to maintaining their farming and livelihood under the recent penetration of a money economy.

Apart from these pioneer works, recent studies focused upon farming technology in specific villages pursuing regional and inter-village differentiation and the changing processes caused by the progress of government irrigation projects and the introduction of modern inputs such as newly improved varieties of seed, farming machines, and chemical fertilizers (Vanpen, 1975: 190-244; Calavan, 1977: 63-133; SOAS, 1978: 41-58, 81-94; Amyot, 1976: 110-140). Recent works by Harvey Demaine and

C.J. Dixon analyse the wide range of socio-economic changes and the problems of differential response among peasants to development opportunity brought about by the government irrigation project in the Lam Pao area of northeast Thailand (Demaine, 1977; Dixon, 1974). The trend in these works directly reflects the rapid change of agriculture in this country brought about since the 1960's.[31]

6. The Purpose and Hypotheses of the Present Thesis

We need here to bring together the threads of the preceding theoretical arguments in relation to the major theme of our present study. Our major inquiries are directed towards revealing the complex situation in Thai peasant farming systems by investigating the conditions and relationships between the ecological and socio-economic contexts of rice farming. The typological approach pursued in attempts to classify agricultural systems has largely failed to elucidate the many relationships between ecological and socio-economic variables in actual peasant farming. The theoretical shortcomings underlying the typological classification seem to be overcome to a great degree in the ecological approach which provides systematic frameworks to deal with the structural relationships between environment, techniques and other socio-cultural variables. It should be noted, however, that many studies in cultural ecology, as indicated by recent criticism, still remain rather within functional and explanatory models of the relationship between man and nature, failing to clarify adaptive dynamics and socio-economic relations involved in peasant farming.

In this connection, the recent results of peasant studies make significant contributions to recognising economic, social and cultural attributes generally common to most peasantries, which are distinguishable from those

in tribal and developed capitalist societies. They suggest an analytic framework focused on the family farm (household unit of production and distribution) and village community, in which these peasant characteristics are most explicitly revealed. It is worth noting, however, that despite the homogeneous characteristics of peasantries, there can be seen, in the South East Asian context, distinctive and historically established forms of peasant production: subsistence production and petty commodity production. It is considered that these distinctive forms have been generated on the ground in different socio-economic conditions of peasant farming, particularly centred around the land tenure situation and the pattern of labour utilisation. Assuming that the concept of technology is principally social and economic as well as environmental, these socio-economic conditions should be investigated in the light of peasant technology indigenously developed within a farming system. The present study, therefore, starts with the assumption that farming systems consist of ecological and socio-economic structures or, in other words, sub-systems, which are interlinked through the mediation of peasant technology.

The main purpose of this thesis is thus to examine the major characteristics of two peasant rice farming systems established respectively in the northern intermontane basins and the Chao Phraya delta of Thailand from a comparative perspective. Our main inquiries will aim to reveal the complex entity of peasant rice farming as a system, in which ecological factors affecting rice-growing and socio-economic conditions in the production process are structurally inter-related. In dealing with this central theme, our particular analytic emphasis is laid upon the peasant technology which is not only the technical component of rice farming but constitutes also a structural

relationship linking the various ecological and socio-economic factors into a farming system. We would argue that the farming system is an integrated entity provided with both ecological and socio-economic structures, which are linked through the role of the indigenous technology available to the peasants. It is suggested that no geographical study concerned with agriculture, particularly with traditionally established farming in the Third World and the peasants who live on it, should ignore such a structural approach. With this general thesis, our inquiry is centrally focused on the two contrasting farming systems long established in Thailand, through an investigation into both ecological and socio-economic contexts in a comparative perspective. In order to attain our purpose we here postulate two hypotheses to be verified in the course of description and analysis in the subsequent chapters.

Firstly, we suggest that two distinctive farming systems of traditional rice cultivation can be detected in the Chao Phraya water system according to ecological and technological conditions of rice-growing. The first is the Intermontane Basin type of peasant farming of northern Thailand based on traditionally developed irrigation systems and an elaborate transplanting culture. The second is the Delta type of peasant farming system established in the Chao Phraya delta, where natural precipitation and annual inundation are traditionally the main resources of water supply, and broadcast-sowing or transplanting methods are applied according to water conditions. Despite recent improvements in water control and irrigation by the government and associated technical changes, these basic characteristics of the two farming systems can still be observed within the respective ecological conditions.

Secondly, we suggest that these two farming systems, in which peasant technology structurally interacts with both ecological and socio-economic conditions, are in turn dominated by different forms of peasant agricultural production. The first is the subsistence production prevalent in the Intermontane Basin established far away from the centre of rice-export, in which peasant technology is primarily devoted to meeting domestic consumption requirements, emphasising use values in the production process. The second is petty commodity production developed in the core area of rice-export agriculture in the Delta farming region, where the peasant technology is concentrated on commercial disposal of the products, in addition to efforts to secure subsistence consumption. The difference in the two forms of peasant production is principally derived from the complex of socio-economic conditions stemming from the processes of land reclamation, land tenure and labour utilisation.

These hypotheses will be first put under investigation at regional level by a comparative examination of the existing data available on the two farming regions in Chapters II, III and IV. It is hoped that the regional examination will reveal the major characteristics of the two farming systems, offering the major contrasts in ecological and socio-economic contexts within the wider settings. This attempt is thought to be necessary not only to demonstrate a typology and the major contrasts between the two farming systems in regional terms, but also to locate the small-scale village study within wider contexts. Subsequently in Chapters V, VI, VII and VIII, our description and analysis will focus on more detailed studies of two selected villages in Chiangmai and Ayutthaya provinces which represent the Intermontane Basin and the Delta types of farming system respectively. The ecological and socio-economic

conditions of the two farming systems will be revealed at village level by making a comparison of fieldwork data on the land reclamation processes, land tenure situation, labour utilisation, irrigation and farming operations. It is our assertion that the peasant farming system can really only be understood when we make empirical and microscopic examination of it based on the fieldwork data.

The data on which the present study is based was mainly obtained during intensive fieldwork in the two selected villages in Chiangmai and Ayutthaya provinces, conducted for 26 months in 1974-75 with further visits in 1977, 1978 and 1979. During the 1974-75 period, the author and his family lived continuously in the two villages for 12 months, participating in most aspects of the peasants' life including various farming operations. Throughout the fieldwork Lannathai and Siamese (Standard Thai) were used respectively in our daily life and research in Chiangmai and Ayutthaya. The basic data on farming and socio-economic conditions were obtained by questionnaire interviews covering all households concerned. The interviews were held with the household heads or those who were able to give accurate data on their own households. The farm technical data obtained in the interviews basically represent the 1974-75 cropping season. The questionnaire data are supplemented by a wide range of field observations and by statistical data from various local offices, from that of the village headman to the provincial level. As for historical materials used in the study, some archival documents held in the National Archives, Bangkok, were used in addition to published materials.

CHAPTER II

ECOLOGICAL ASPECTS OF RICE CULTIVATION

The main purpose of this chapter is to indicate the ecological aspects of rice farming by investigating the ecosystem of the wet-rice field and water availability in relation to physiographical and hydrological conditions in the Chao Phraya water systems of Thailand. This attempt is made to provide a basic ecological setting for peasant farming systems as a complex entity consisting of ecological and socio-economic structures. Our discussion will first investigate the ecosystem of the wet-rice field which allows continuous tillage efficiently over many years through artificial submergence. Recognising the basic mechanism of the flooded rice field ecosystem, we shall subsequently examine the water requirement in rice cultivation with reference to the uncertainty of monsoon rainfall within Thailand, emphasising the necessity for supplementary irrigation. This is followed by an examination of the topographical classification of rice fields put forward by Yoshikazu Takaya with particular emphasis upon water availability. In doing so, we set up a regional focus to be discussed in subsequent chapters on the intermontane basins and the Chao Phraya delta in terms of the historical, cultural and economic significance of rice cultivation in Thailand.

1. The Ecosystem of the Flooded Rice Field

The wet-rice cultivation developed in many Asian countries is essentially different from various types of upland cultivation practised mainly on slopes and in hilly terrains in the temperate zones and tropics. The major traditional rice-growing areas are concentrated within the alluvial plains of large rivers in areas where the monsoon climate is predominant. The basic contrast between upland cropping and wet-rice cultivation concerns the transformation of generalised natural ecosystems into specialised artificial ecosystems. Many traditional forms of upland cropping, especially shifting cultivation, may be accomplished by replacing the natural ecosystem with cultivated crops, which perform functional roles essentially similar to those fulfilled by wild species in the natural ecosystem. Such manipulation of the ecosystem in an upland farming system is accomplished "not by drastically changing its diversity index but by altering selected components without fundamentally modifying its overall structure" (Harris, 1969b: 6). Thus the plot cultivated by the shifting method may be regarded as a sort of 'miniaturised tropical forest' composed of food-producing cultivates, rather than as simply a field (Geertz, 1963: 25). The transformation into the specialised ecosystem of an upland plot can usually cause a considerable loss of the primary productivity which could be maintained in the original natural ecosystem.[1] The attempts at crop rotation and fallowing, which are basic characteristics of upland farming, are primarily intended to maintain soil fertility and even to preserve the natural ecosystem as far as possible. In the highly specialised agricultural systems such as mixed farming in western Europe, such attempts are essentially made through crop rotation together with animal

husbandry.

In contrast to upland cropping, wet-rice cultivation is carried out through a more drastic transformation of the natural ecosystem and requires greater artificial alteration of the environment. After clearing trees and shrubs by the slash and burn method and after removing stumps and other obstacles, the plot for wet-rice cultivation is levelled and diked to allow inundation of the field for a considerable period during the rice-growing cycle. By these methods, the generalised natural ecosystem (which in Thailand might be monsoon forest or, in some localities, less productive savanna forest) is transformed into an extremely specialised ecosystem with a single crop under continuous cultivation. The exploited rice field, quickly decomposing and reducing organic matter in the soil for subsequent years, ultimately reaches a newly-created equilibrium under conditions of artificial flooding. The newly created ecosystem, in contrast to the upland ecosystem which is, more or less, a replacement of some wild species in the natural ecosystem, is actually a sort of fresh-water marsh ecosystem, and in many cases is quite different from the previous vegetation (Odum, 1975: 184). In the rice field ecosystem, the diversity index is low and the component species are reduced to adapt to submergence; besides rice plants certain species of weeds selectively increase as primary producers together with phytoplankton, or microscopic suspended plants such as diatoms and algae; and the consumers and the decomposers are also considerably different from those in most non-irrigated ecosystems including upland fields.

As many scholars have noted, the most striking feature of the rice field ecosystem is the fact that the rice plant can produce undiminished yields without any serious loss of soil fertility despite

continuous cultivation even over long periods; the flooded condition certainly performs significant roles in maintaining such a stability (Pelzer, 1945: 49-50; Murphy, 1957: 191; Geertz, 1963: 29-30). The supply of ample water to the plant is physiologically essential only for a relatively limited period of its growth. It has long been proved, however, that inundation assures in large measure nutrition of the plant, and amongst other things also helps to prevent the growth of weeds (Matsuo, 1961: 143; Yamada, 1965: 13-23; Grist, 1975: 37). The mechanism by which flooding assists the growth of the plant in the ecosystem has been revealed to a considerable degree in recent studies of rice cultivation in both the tropics and in temperate lands.

One of the crucial advantages of submergence is believed to be related to the process of soil reduction by which various nutrients become available to the rice plant. According to Pierre Gourou, the poverty of soils in the humid tropics is largely due to the rapid waste of nitrogen under high temperatures. In tropical upland soils the organic matter is quickly decomposed and reduced into nitrates which are dissolved by the water and finally lost (Gourou, 1966: 21). Under conditions of flooding, however, decomposition of organic matter is considerably restrained, and therefore the loss of fertility is less than in the case of upland soil. The content of organic matter in the rice field soil is relatively high, since it usually contains stalks, stubble and other remains of harvested crops as well as material supplied by the water itself. The bacterial decomposers peculiar to the submerged soil, absorbing molecular oxygen and subsequently nitrate, break down the organic matter and release simple mineral nutrients. In such a successive process of soil reduction, ammonium is finally released at the stage of ferrous iron formation after the disappearance of nitrate

(Motomura, 1969; Takai, 1969: 20; Motomura, 1975: 78-87). The rice plant cultivated in the flooded condition usually takes up nitrogen in the form of ammonia which is stabilised in the reduced soil, while nitric nitrogen may be predominant in most oxidised upland soils (Pelzer, 1945: 50; Motomura, 1975: 85-86).

The decomposers, heterotrophic organisms which perform crucial functions in the course of soil reduction,vary as between rice fields and upland ecosystems. It is now widely known that various kinds of aerobic bacteria and facultative anaerobic bacteria working in the reduction process up to the formation of ferrous iron are generally abundant in the rice field ecosystem. On the other hand, fungi, actinomycetes, and nitrifiers are more predominant in the less humid and oxidised soils of the upland ecosystem (Takai, 1969: 20; Motomura, 1975: 81). The content of ammonia produced by bacterial decomposition has a serious effect upon the rice yield, and is nearly always determined by the quality and quantity of organic matter in the flooded soil. Although the remains of harvested crops and weeds are turned into the paddy soil by ploughing every year, the tropical soils usually contain poor humus. For this reason, it is said that the amount of ammonia produced in rice fields is relatively small in mainland South East Asian countries including Thailand (Kawaguchi and Kyuma, 1969).

Another characteristic feature of the ecosystem of the rice field, especially in the tropics, may be the role of nitrogen-fixing organisms in maintaining soil fertility. Many scholars have pointed out that blue-green algae and some micro-organisms floating in the water effectively fix considerable amounts of nitrogen in the reduced soils, and consequently enhance soil fertility in South and South East

Asian countries (De, 1936; Shioiri et al., 1944). These blue-green algae, photosynthetic micro-organisms living as producers like rice plants in the rice field ecosystem, require light and nutrient supply (especially phosphorus) but do not need either organic matter or nitrogen (Grist, 1975: 244).[2] Such favourable algae thrive in water under high termperatures (30-35°C). The amount of nitrogen fixed by blue-green algae is reckoned at between 15 and 50 kg/ha under water-logged conditions in India (De and Mandal, 1956: 453-458). In Thailand, Matsuguchi, examining the distribution of nitrogen-fixing organisms during main season cultivation within the major soil groups, has found that their population varies according to the pH value and available phosphorus content of the soils. It has been proved that soils with high pH values tend to contain large amounts of fixed nitrogen, which is estimated to be between 11.3 and 29.8 kg/ha per annum (Matsuguchi, 1971: 30-35; Motomura, 1975: 90-91).

Phosphorus is released in a usable form for the plant in the course of bacterial decomposition of organic matter in the flooded field. It has been argued, however, that the phosphorus content of paddy soils is rather low in most South East Asaian countries (Kawaguchi and Kyuma, 1969: 000-000). On the other hand, potash and other inorganic bases are present in abundance, apart from in a few regions of South East Asia,[3] due to ample natural supply through rivers and canals. Although the rice field ecosystem is on the whole advantageous for traditional methods of rice-growing in the tropics, it also has its drawbacks, such as the depletion of oxygen from the subsoil and the accumulation of harmful organic acids. Rapid reduction of organic matter leads to the accumulation of various organic acids, which retard root development, and cause root rot

(Grist, 1975: 37; Motomura, 1975: 97). To avoid such drawbacks more sophisticated water management, including intermittent drainage for a certain period of the growing season, may be required (Motomura, 1973).

Thus it can be said that by maintaining a flooded, aquatic environment, the ecosystem of wet-rice cultivation is highly efficient and extraordinarily well adapted especially to lowlands in the humid tropics, where upland or dry field cropping might be inadequate and unstable. Artificial submergence, in many cases carefully created, seems to assure the stability and durability of rice farming against losses caused by continuous tillage, since under such an environment, exchanges of material can be efficiently worked between the components including the rice plant as a primary producer. It is now widely agreed that the process of soil reduction and the role of nitrogen-fixing organisms are major key mechanisms of the material exchange which allows rice farming to be practised continuously in the otherwise harsh environments of the tropics.

As Eugene Odum rightly points out, wet-rice cultivation is "one of the most productive and dependable of agricultural systems yet devised by man" (Odum, 1975: 184). Such ecological efficiency is undoubtedly derived from its highly artificial nature, which concentrates on maintaining the plants in the submerged condition. The distinctive landscape of the rice field ecosystem may ideally be characterised by completely levelled plots with carefully built dikes which are often accompanied by well-maintained farm ditches watering the plots, though these latter works are less common in extensive broadcast-sown fields subject to natural flooding in deltaic regions. All these artificial works peculiar to rice fields, which are chiefly intended to retain water, clearly require, in both their construction and maintenance, larger amounts of peasant

labour input than in any other agricultural system. Rice cultivation generally needs a high labour input for water control operations in addition to the amount of labour involved in routine farming tasks, from land preparation to harvesting (Ruthenberg, 1976: 188-189). With the accumulation of such extra operations over many years, the rice field ecosystem is gradually altered to attain more favourable and more controllable water conditions. (Small, 1974: 679-683). In contrast to upland farming which tends rather towards preservation of the natural ecosystem, wet-rice cultivation can only be improved efficiently through highly artificial alteration of the environment, a process akin to hydraulic engineering.

2. Water Requirement in Rice Cultivation within Thailand

Since the components of the rice field ecosystem most efficiently interact under submergence, it is clear that ample water supply is one of the most crucial factors in rice cultivation. The amount of water required for the growth of the rice plant is normally estimated as the total amount of transpiration from the plant in addition to evaporation and percolation from the cultivated plot, measured from transplanting until maturity. The water requirement thus calculated varies very much according to various environmental factors such as climatic conditions, soil characteristics, level of the groundwater table, methods of cultivation and the length of growing period. Peter Kung gives 800 to 1,200 mm as the average requirement in Asia, with the daily amount 6 to 10 mm (Kung, 1966: 000). The actual water requirement for the entire period of farming operations, however, must be larger than the above figures, since additional water is required for land preparation and for nursery beds in the transplanting method, and

for sowing in the broadcast-sowing method. From experiments in the Chao Phraya delta of Thailand, Kung et al. show that the water requirement for complete growth of the plant is estimated to be about 1,240 mm in which 40 mm are needed for the nursery, 200 mm for land preparation and 1,000 mm for irrigation (Kung et al., 1965: 11-12). Many geographers give even higher figures of about 1,700 to 1,900 mm for optimum yield in tropical monsoon Asia.[4] In a recent survey of the northern region of the Greater Chao Phraya project, Kaida found that total water supply, i.e. irrigation water plus effective rainfall, was 1,500 ± 200 mm for transplanted rice and 1,600 ± 220 mm for broadcast-sown rice (Kaida, 1971: 264).

Throughout Thailand, with the exception of quite limited areas of the southern peninsula, the total amount of monsoon rainfall for a growing period of about 180 days from June to November is considerably lower than the water requirement. As shown in Table 1, the average rainfall over a thirty-year period is 1,157.4 mm for Bangkok in the delta, and 1,018.3 mm for Chiangmai in the northern intermontane basin. Taking into account the rainfall loss, about 75 per cent of these amounts should be considered as effective precipitation for rice field cultivation (Kaida, 1971: 264). Thus, even a cursory examination of meteorological data shows that the rainfall is so far from sufficient that rice cultivation requires the application of additional water by irrigation.

In Thailand, a further disadvantage of monsoon rainfall is unreliability. During the first half of the rainy season from May to August, which corresponds to the vegetative growth period of the rice plant, rainfall is extremely localised and occurs as sudden downpours (Kaida, 1978: 206). The precipitation can cover only small areas

TABLE 1: Average Monthly Rainfall and Temperature at Chiangmai and Bangkok, 1931-1960

Season	Month	Chiangmai		Bangkok	
		Mean rainfall mm	Mean temperature* ^{0}C	Mean rainfall mm	Mean temperature* ^{0}C
na laeng (Dry season)	January	6.6	21.3	9.0	26.2
	February	11.7	23.1	28.6	28.0
	March	14.6	26.0	34.3	29.3
	April	48.7	28.6	89.4	30.1
na fon (Rainy season)	May	143.6	28.6	166.3	29.7
	June	146.2	28.0	170.7	29.0
	July	188.3	27.4	177.9	28.5
	August	230.8	27.0	190.9	28.4
	September	288.6	26.9	305.9	28.1
	October	125.9	26.2	254.7	27.7
na laeng (Dry season)	November	38.5	24.6	57.3	26.9
	December	10.0	21.8	7.1	25.6
Annual total		1253.5	25.8	1492.1	28.1
Total Jun-Nov		1018.3		1157.4	

* Mean temperature, 1937-1960.

Source: Sawat, 1973: 89-90.

distributed in patches in this period. Furthermore, as a rule, the onset of monsoon rainfall may vary by up to two months from year to year. This causes much inconvenience in broadcast-sown areas, where peasants must await the first rains before they begin their farming. In addition, a dry spell from the end of July lasting about two to four weeks may adversely affect the vulnerable young plants, and might even cause severe drought. Since transplanting is normally practised in July or August, a prolonged dry spell often causes delays and might even cause such water deficiency that transplanting is impossible. From September onwards the rainfall pattern becomes stable, owing to the influence of cyclonic rain throughout the country. The relatively constant rainfall during the latter half of the rainy season, providing the largest quantity of precipitation in September, can sharply raise the water level in rivers, and in the Chao Phraya delta may cause the gentle inundation of a vast area lasting up to November. However, in the tributary valleys of the northern intermontane basins, sudden floods are apt to inflict serious damage on rice fields in this period (Credner, 1935: 91-92).

In addition to irregularity of timing, monsoon rainfall may vary considerably in total from year to year (Credner, 1935: 74-75; Kyuma, 1978: 168-169). Relevant meteorological data for selected localities over a twenty-nine year period are shown in Table 2. This table shows differences of as much as thirty days in the number of rainy days throughout the country. Average annual rainfall shows striking yearly fluctuations of more than 1,000 mm in the Chao Phraya delta and in the northern intermontane basins, and of about 500 mm in the drier Nakhon Ratchasima region of the north-east. The fluctuation and irregularity peculiar to monsoon rainfall, together with its

TABLE 2: Annual Rainfall and Number of Rainy Days, 1948-1976

	Rainy days		Annual rainfall mm	
	Average	Range	Average	Range
Bangkok	134	118-150	1509	876-1957
Chiangmai	122	105-138	1285	865-2032
Nakhon Ratchasima*	120	109-139	1182	920-1400

* Data in 1948 and 1970 are lacking.

Source: Thailand-National Statistical Office, 1970: 22-23;
Thailand-National Statistical Office, 1977: 22-23.

deficiency in total amount, are important causes of crop failure in Thailand.

In the Chao Phraya delta where rice cultivation has long been dependent on annual inundation from rivers to supplement natural precipitation, the highest water level in the rivers can indicate to a certain extent the general conditions of rice-growing in any particular year. The Royal Irrigation Department has kept records of the highest water level each year since 1831, measured at Ayutthaya, when King Rama III ordered the installation of a stone pillar gauge in the Chao Phraya river channel. According to these records, which span a period of 124 years from 1831 to 1954, in only four years were floods disastrous enough to cause serious crop damage, while there are sixty instances in which the water level fell below 3.50 m M.S.L., a level below which drought damage ensues (Thailand, 1957: 133-134). This implies that until the recent improvement of water control under large-scale government projects, rice cultivation in the delta was hampered to a considerable degree by drought almost once every two years. In the worst years the area damaged by extreme drought could amount to between 30 and 40 per cent of the total cultivated area. Even during years of quite normal climatic conditions, considerable variations have occurred between the total cultivated area and the total harvested area throughout the country (Thailand, 1957: 135). In most "normal" years in the delta, about five to ten per cent of the total cultivated area suffers damage through shortage of rain in May and through excessively dry conditions in July and August. Even in the intermontane basins of northern Thailand where irrigation systems have long been developed at various levels, considerable drought damage, especially during the transplanting period, has been widely observed in many

localities (Watabe, 1967: 22-23). In the Korat plateau in north-east Thailand the fluctuation of the rainfall regime is even more pronounced, and drought conditions occur more frequently (Ng, 1978: 38-39).

Obviously, monsoon rainfall, which must ultimately be the main water resource for rice farming, is not regular or dependable enough to supply sufficient water to the aquatic ecosystem of rice fields. Especially during the first half of the rainy season it is extremely unstable, and it is therefore difficult to maintain standing water continuously in the fields during the vegetative growth period, unless supplemental water is adequately supplied. Thus supplementary irrigation is highly necessary in most parts of the country, and should be concentrated essentially in the vegetative growth period. It has been pointed out that as far as rainfall is concerned, rice in Thailand is grown under relatively unfavourable and harsh conditions (Dobby, 1958: 270; Kyuma, 1978: 168-169). Since other environmental factors such as microclimate, temperature, and length of daylight are largely favourable, and do not adversely affect rice cultivation, water supply is one of the most vital factors, together with soil conditions, to be considered in traditional rice cultivation.

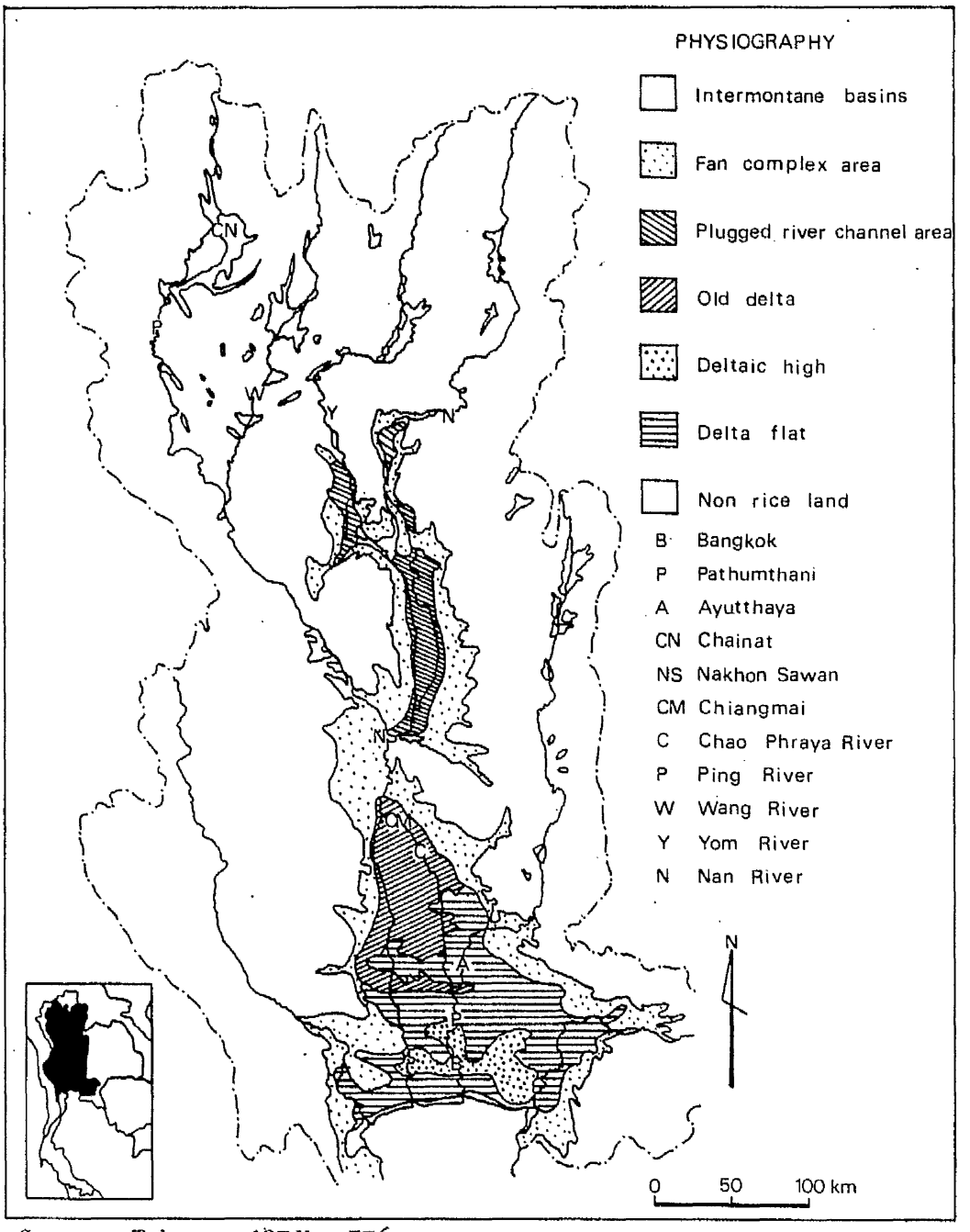
3. Topographical Classification of the Chao Phraya Water System

The efficiency of the rice field ecosystem, which needs artificial submergence for most of the growing period, depends to a great extent on the availability of water resources supplementary to unreliable rainfall. Relief, which controls surface and ground water, has been one of the most vital environmental factors in traditional rice cultivation. Since irrigation is principally a sort of earthbound engineering concerned with the manipulation and transfer of natural water resources, its

method and system are strictly determined by the hydrographical aspects of relief. At the same time the water availability of a rice field is closely associated with techniques of land preparation and other farming operations. Thus, it can be argued that the topographical classification of rice fields is quite helpful not only in indicating the distribution and availability of natural water resources, but also, in doing so, by providing a basis for the understanding of the whole process of traditional farming technology. In particular, the classification by larger units of topographical features serves the purpose of identifying regional variations in irrigation and farming techniques.

Various attempts have been made to describe and classify landforms in Thailand (Credner, 1935; Brown, 1951; Pendleton, 1962: 34-62). However, since most of these attempts aim to provide general descriptions of physiographical regions, they are not necessarily relevant to the specific conditions of rice cultivation. But in recent years one of the most comprehensive physiographical surveys of conditions in rice fields has been carried out by Takaya, with great emphasis upon water availability, in the Chao Phraya water system (Takaya: 1969: 293-300; Takaya, 1971: 375-397). According to his survey, six physiographical regions[5] are classified along the water system in terms of geomorphological and hydrographical aspects: the Intermontane Basin, the Plugged River Channel Area, the Old Delta, the Delta Flat, the Deltaic High and the Fan-terrace Complex Areas. Major characteristics of these regions can be summarised as follows (Figure 2, Table 3).

Intermontane Basin. Intermontane Basins are situated along the upper tributaries of the Chao Phraya river in northern Thailand, including the major basins of Chiangmai, Lampang, Phrae and Nan, which can be regarded as a southern extension of the river basin system of



Source: Takaya, 1971b: 376.

Figure 2: Physiographical Regions of Riceland in the Chao Phraya Water System

TABLE 3: Major Characteristics of the Six Physiographical Regions of the Chao Phraya Basin

Physiographical region	General slope (m/km)	Local relief (m)	Catchment/paddy area ratio
Intermontane Basin	1.7<	<10	10-40
Plugged River Channel Area	0.2	±5	32.8
Old Delta	0.15	<8	23.0
Young Delta: Delta Flat	0.01	negligible	15.6
Young Delta: Deltaic High	0.01	negligible	15.6
Fan-Terrace Complex Areas	1.0-2.5	<10	5.1

Source: Takaya, 1971: 395.

South West China. Although the terrain of an intermontane basin consists of many topographic units, most rice fields are developed on recent alluvial plains, low terraces, or on recent fans. Since the basins are surrounded by large catchment areas with dendritic stream networks, the catchment/paddy area ratio is such that all the basins are adequately watered. In this region peasants have developed a traditional irrigation system, customarily called the müang-fai system, which is composed of a diversionary weir (fai) and regular networks of canals (müang). Since slopes are generally moderate, the natural flow of rivers in the Intermontane Basins can be held back at artificial weirs and allocated to adjacent areas by gravity.

Plugged River Channel Area: This area consists of low depressional stretches along the Nan and Yom rivers in the middle reaches of the water system, and has an average width of about 20 km. This recent alluvial valley receives enormous amounts of water with a high catchment/paddy area ratio of 32.8 and an extremely high stream density. Since floods are plugged at a bottle-neck-like gorge located at the downmost reach, the area has deep and prolonged inundation. Rice cultivation is practised in the deep flooded backswamps and most settlements are located on levees developed along active river courses, from which people have easy access to nearby rice fields. Within this area, sophisticated water control is well-nigh impossible.

Old Delta: The Old Delta, occupying the upper part of the Chao Phraya delta, has an irregular fan-shaped configuration with the apex at Chainat, and stretches along the main channel of the Chao Phraya and its distributary channels, the Suphanbur (Thachin), Nọi and Lopburi rivers, southwards towards Ayutthaya. The area is geomorphologically defined as an upper pleistocene delta, upon which recent

levee deposits have been partially superimposed. (Takaya, 1968: 67-68; Takaya, 1971a: 46-57). The elevation is between 5 and 20 m with the general slope of 0.15 m/km in a N - S direction and local relief reaches more than 5 m above mean sea level. The repeated bifurcation of river channels forms a network of spreading distributaries with well-developed natural levees.

The area, having quite large water resources with a catchment/paddy area ratio of 23.0, has been a traditional rice granary of Thailand, and since the Ayuttaya period (1350-1767 A.D.) has contained a relatively densely-settled population. Until the introduction of modern irrigation schemes under the Greater Chao Phraya project during the 1960's, the distribution of rice fields, however, was largely restricted to depressional backswamps. The early developed plots distributed along the chains of depressions were often watered by primitive tertiary canals excavated from natural water courses. But once a modern irrigation scheme was introduced, farmers began to prefer the elevated parts which were formerly considered as barren.

Delta Flat: The Delta Flat, together with the Deltaic High comprising the lower part of the Chao Phraya delta, is really low-lying young delta with an elevation of less than 2 m, general slope of 0.01 m/km, and almost no local relief, stretching from around Ayutthaya to the coast of the Gulf of Thailand. It should be noted that this young delta includes extensive tongues of land (the so-called 'arms' of the delta) which stretch into the Old Delta and marginal fans northward from Ayutthaya to Singburi and westward from Ayutthaya to Suphanburi (Takaya, 1969: 293-300; Takaya, 1978: 174). The Delta Flat, together with the Deltaic High is considered in geomorphological terms the youngest part of the plain and is thought to have risen from the Gulf

of Thailand during the past few thousand years. The whole area of the Delta Flat is subject to inundation during the rainy season, and the so-called "arms" experience especially deep and prolonged floods. A further peculiarity of this area is that owing to the brackish environment, acid sulphate soil is extensively distributed (Moorman, 1963: 271-279). This vast flat land which is almost a kind of amphibious terrain with ubiquitous swamps remained sparsely populated and uncultivated until the latter half of the nineteenth century when riceland reclamation was initiated in response to rising foreign demand for rice.

Deltaic High: The Deltaic High is a slightly elevated part of the young delta with an average elevation of 3 m, occasionally reaching 5 m and with a general slope of 0.01 m/km. As Figure 2 shows, the Deltaic High stretches northwards, westwards and eastwards from the site of Bangkok. This slightly elevated terrain is thought to represent old beach ridges or a former complex of natural levees. This area has about 1 m higher elevation, a slightly stronger local relief and higher stream density than the surrounding Delta Flat area. Owing to these distinctive topographic conditions, the flood depth of this area is shallower, and water drains more rapidly, than is the case elsewhere in the Delta. Today, reflecting topographical conditions, this area is characterised throughout by the cultivation of transplanted rice, whereas the Delta Flat is mostly given over to broadcast-sown rice.

Fan-terrace Complex Areas: The Fan-terrace Complex Areas are distributed along the marginal parts of the middle and lower reaches of the water system, and occupy a transitional zone between the plain and the mountain ranges. Throughout these areas, the general slope is 1.0 m/km to 2.5 m/km and local relief is strongly developed. Most

parts of this area are made up of recent and upper pleistocene fans. The Fan-terrace areas, in fact, represent a complex consisting of many different kinds of small fans and terraces. Owing to the smaller catchment/paddy area ratio of 5.1, and to the predominance of short and steep streams, water supply in the area is extremely erratic and deficient. Problems of water supply are aggravated by the presence of porous substrata which allow rapid sinking of water into the ground. The rice fields, which were probably first developed along the base of the fans, have been extended upslope, water being drawn from streams by gravity, in the same way as in the Intermontane Basins. The recent expansion of rice fields on the water-deficient marginal fans may be attributed to the exhaustion of further possibilities for land reclamation in the delta.[6]

From this brief description of the six physiographical regions of the lower Chao Phraya basin, it is clearly apparent that physiographical and hydrographical factors exert a significant influence upon water availability and upon the means of water utilisation to be employed in each region. Topographical and hydrographical features also influence farming procedures, as shown for instance in differences between the broadcast-sowing and transplanting methods of rice cultivation. In this connection, topography and hydrography are not merely a sort of general environmental factor but indeed the 'effective environment' (Netting, 1965: 82). However, though these effective factors are extremely vital, peasant cultivators have actually attempted, to a certain degree, to alter and manipulate them. Here, indeed, is some scope for peasant technology in which irrigation occupies a crucial part. Peasant technology has always worked to the given factors of topography and hydrology in order that all components fulfil their

function in the rice field ecosystem.

Another point implied in the classification of physiographical regions is the fact that each physiographical unit or region has undergone its own particular historical evolution.[7] For instance, the Intermontane Basins in northern Thailand with their favourable conditions in which peasant technology worked effectively, were probably amongst the earliest places to be settled and cultivated. On the other hand in the deltaic regions, with the exception of the Old Delta which must have been a fertile granary since the fourteenth century, substantial development of land reclamation for agriculture did not occur until the late nineteenth century. As has already been noted, the expansion of riceland in the Fan-terrace Complex Area is a quite recent development. Therefore, it can be reasonably concluded that there is, to a considerable degree, a close relationship between the physiographical regions and the historical development of rice cultivation within them, which is possibly accompanied by regional differentiation in culture. Thus in the classification of farming systems of rice cultivation, technological similarities and differences should be investigated according to the basic variations in topography and hydrography, taking into account historical and cultural backgrounds.

At least two contrasting farming systems can be observed in traditional rice cultivation within the Chao Phraya water system. The first is the Intermontane Basin type of cultivation which is characterised exclusively by the transplanting method depending on a well-maintained system of gravity irrigation, and is mainly found in the Intermontane Basins of Takaya's classification. Another is the Delta type of cultivation practised in the Chao Phraya delta which corresponds to Takaya's Old Delta, Delta Flat and Deltaic High regions. Traditionally

this type of cultivation depends basically on irrigation by flood, and cultivation methods, whether broadcast-sowing or transplanting, varying according to local water conditions. In the remaining two physiographical regions - the Plugged River Channel and Fan-terrace Complex Areas - the relationship between physiography and farming technology is less simple. These two regions share some technological characteristics with both the Intermontane Basin type and the Delta type of farming system. For example, the cultivation of late varieties in the prolonged and deep floods in the Plugged River Channel Area might be regarded as quite similar to that practised in some areas of the delta, while the cultivation of transplanted rice watered by a gravity irrigation system similar to that of the Intermontane Basins is widely found, though in less efficient form, throughout the Fan-terrace Complex Areas. There are, however, many differences between these regions in physiography and other relevant factors of the natural environment which might explain local socio-economic and even historical peculiarities.

But the present thesis intends to deal only with the two farming systems mentioned above. This is because clearer contrasts in ecological and socio-economic aspects can be observed, the data are comparatively abundant in those two farming regions and, more significantly, the two farming regions correspond closely to the historical and cultural core areas of the Lannathai and Siamese kingdoms. The intermontane basins in northern Thailand were the major living space where the Lannathai kingdom (1291 - c.1900), centred at Chiangmai, flourished until Siamese annexation at the beginning of this century. On the other hand, relatively stable rice production in the delta was the economic basis of the powerful Siamese kingdom throughout the Ayutthaya (1350 - 1767

A.D.) and the early Ratanakosin (1782 - 1868 A.D.) periods, and the remarkable growth of Thai export-rice agriculture after the end of the nineteenth century was certainly derived from rapid reclamation of ricelands in this region. Thus the two farming systems can be considered to represent the most important regions of rice production in Thai history.

4. Conclusions

The cultivation of wet-rice has been established through a drastic transformation of a natural ecosystem to a highly specialised one, in which a single crop, rice, can continuously produce undiminished yields even over long periods. The efficiency of the rice field ecosystem is undoubtedly derived from artificial efforts to maintain the field under submergence during the greater part of the cultivation period. In rice cultivation, therefore, the peasants' efforts must mainly be devoted to creating and maintaining favourable water conditions for assuring proper flooding in the fields. In most parts of Thailand, however, monsoon rainfall,which is the main water resource for rice cultivation, is notably irregular and unpredictable, thus being unable to offer a sufficient water supply for the rice fields, particularly during the first half of the growing period. Thus, supplementary irrigation is highly necessary in the vegetative growth period in every part of Thailand.

Under such an ecological setting, physiographical and hydrological conditions have a significant effect on water availability in the rice fields. Thus a topographical classification of ricelands laying emphasis upon hydrological conditions, indicating irrigation methods and their associated farming technology, provides a basic framework for understanding systems of rice cultivation. On the basis of such a

topographical classification, together with historical and cultural factors, we can distinguish the two major farming systems long-established along the Chao Phraya water system, i.e. the Intermontane Basin type and the Delta type.

CHAPTER III

THE INTERMONTANE BASIN TYPE OF PEASANT FARMING SYSTEM

The main purpose of this chapter is to indicate the regional characteristics of the Intermontane Basin type of peasant farming system developed in the northern part of Thailand. This objective may be attained by examination of the natural environment, farming technology and socio-economic conditions involved in peasant rice farming on the regional scale, with special emphasis upon the relationships between them. We shall first delimit the region of the farming system and examine physiographical and other natural environmental conditions relevant to rice cultivation and to peasant life as a whole. This is followed by a section dealing with farming technology, mainly focusing upon irrigation as the core technology of rice farming and the cultivation methods dominant in the region. We shall, in turn, examine socio-economic conditions in the peasant farming system, by investigating the dominant form of peasant production which tends mainly towards subsistence, and the current land tenure situation focusing on the development of tenancy. A concluding discussion of this chapter may be found at the end of the next chapter, in an attempt to make comparisons between the two farming systems.

1. Natural Environment

This type of peasant farming is distributed in the intermontane basins and tributary valleys throughout the seven northern provinces of Chiangmai, Lamphun, Lampang, Phrae, Nan, Chiangrai and Mae Hongson (Figure 3). It includes not only the major basins and alluvial valleys of the Ping, Wang, Yom and Nan rivers in the upper reaches of the Chao Phraya water system, but also those along the tributaries of the Maekhong and Salween water systems around, for instance, Chiangrai, Phayao, Chiangkham, Mae Hongson and so on. The Intermontane Basin type also extends along the Pasak river south-eastwards into Phetchabun province. Most northern provinces lie in fairly mountainous terrain in which the area under cultivation of about 4,101,974 rai (656,316 ha), measured in 1971, accounted for only 7.3 per cent of the total land area (8,948,400 ha in the seven provinces). The total area planted with wet-rice in the same year amounted to 3,326,624 rai (532,260 ha), making up 81 per cent of the total cultivated land area (Thailand-Ministry of Agriculture, 1972: 13).[1] The rest is mainly planted with various field crops such as tobacco, soybeans, sugar cane, peanuts, garlic and pepper, and in fruit trees such as lamyai or longan (Nephelium Longana). Thus, as in the Chao Phraya delta, wet-rice cultivation dominates throughout the Intermontane Basin farming region.

As shown by Takaya, most of the ricelands of the region are distributed on recent alluvial plains, on low terraces or on recent fans. In many basins the alluvial plains with recent loamy and clayey deposits are relatively narrow. The extensively-developed low terraces and fans, with their gentle slopes of less than two per cent and their clayey soils provide the main rice cultivating area (Scholten, 1974: 35). In the Chiangmai basin, as shown in Figures 4 and 5, the wet-

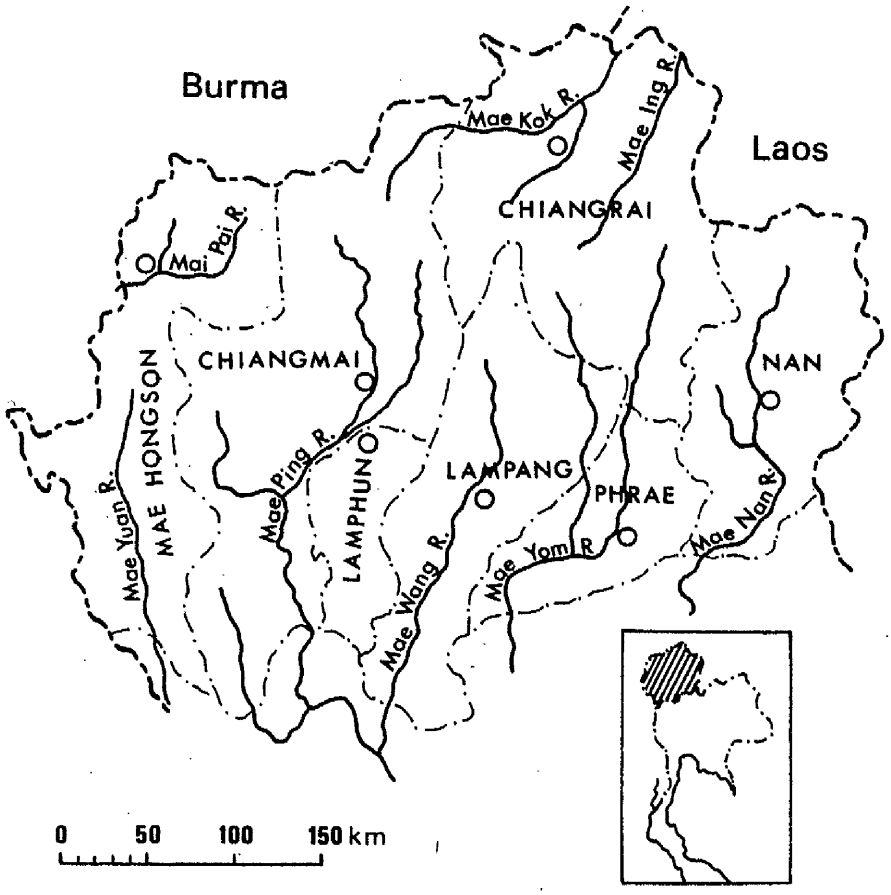
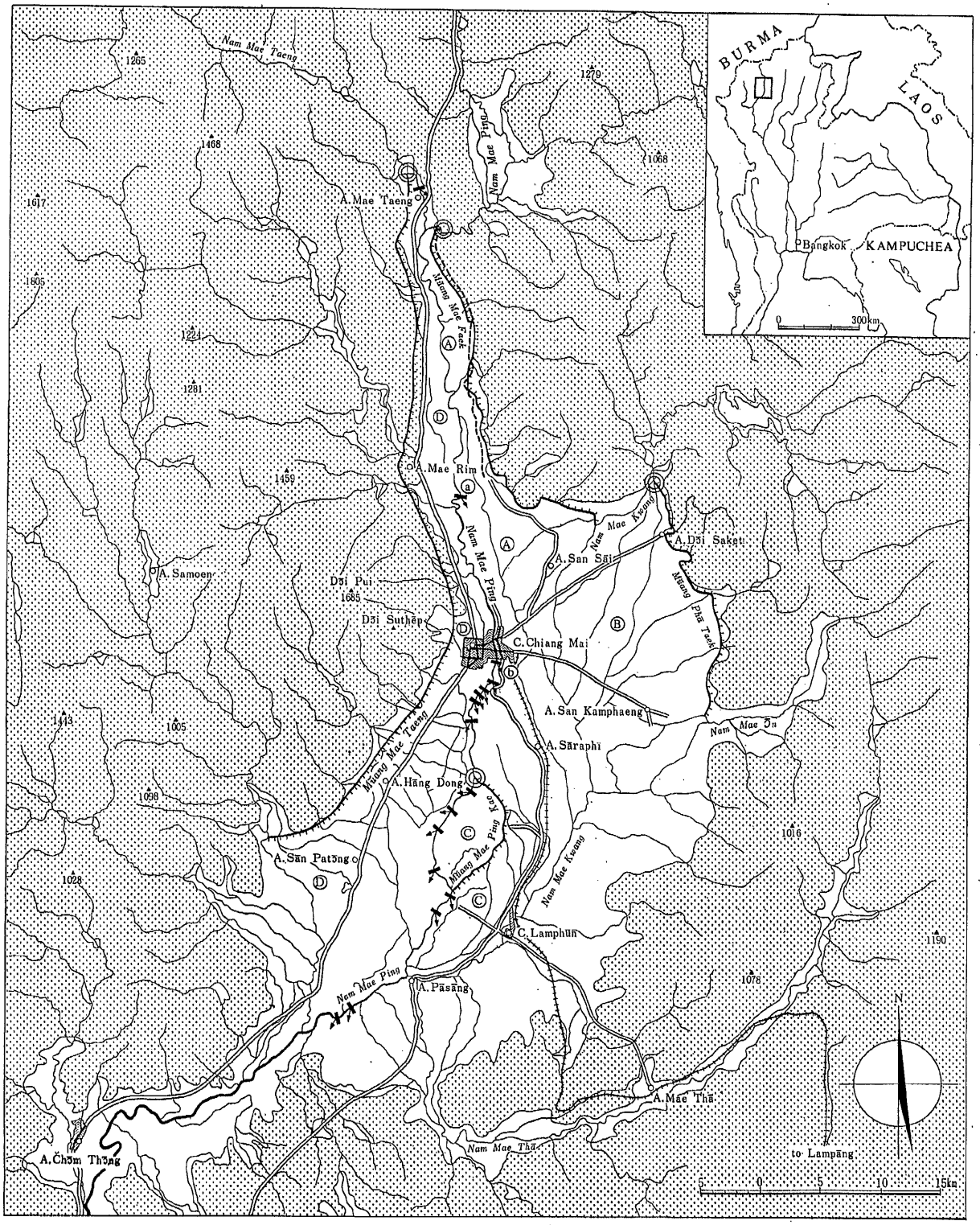


Figure 3: Region of the Intermontane Basin Type of Rice Cultivation

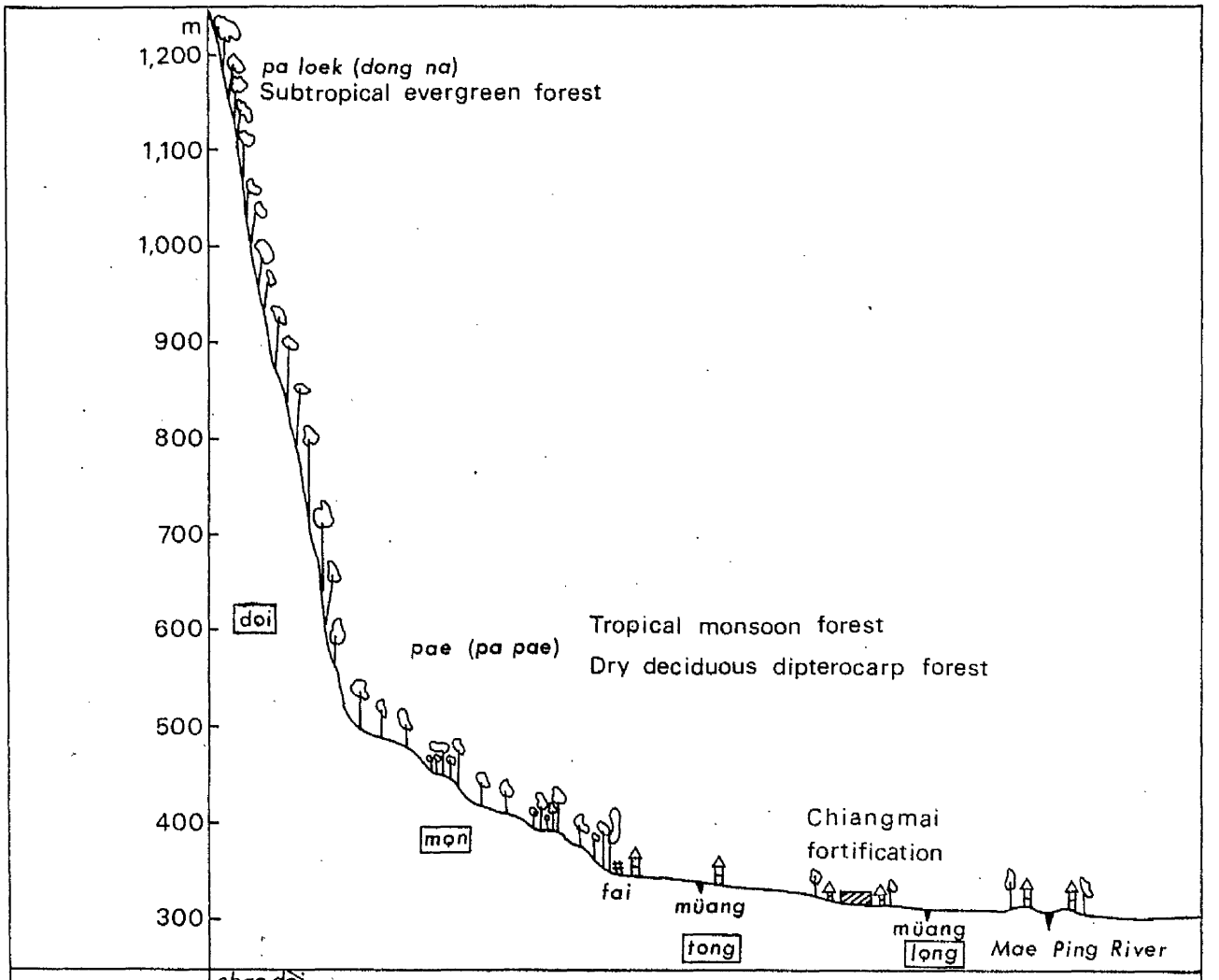


: paddy fields
: hill and mountain area
: river channel
: road
: railway
: urban area

: prefecture or district center
: headworks of the integrated barrage project
: main canal of the integrated barrage project
: estimated remains of *Mūang Khaang*
: traditional *fai* of the alluvial plain type

Ⓐ : *Mae Faek* Project
Ⓑ : *Mae Kwang* Project
Ⓒ : *Mae Ping Kao* Project
Ⓓ : *Mae Taeng* Project
Ⓐ : *Fāi Wang Lao*
Ⓓ : *Fāi Phayā Kham*

Figure 4: Irrigation Projects in the Chiangmai Basin



Population			chao doi (hill tribes)	Lannathai (Yuan, khon müang)	
Physiography			Mountain / Hill	Tributary valleys and fan	Alluvial plain
Subsistence activities	Fundamental	Main season	–	*hai* (Upland rice cultivation)	*na* (paddy cultivation): *khao do* (early varieties) / *khao pi* (late varieties)
		Off-season	–	–	*khao na laeng* (off season rice), tua luang (soybean), *bai ya sup* (tobacco leaf), *kathiam* (garlic) etc.
	Supplementary		–	Collection of edible plants, fuel and raw materials for artifacts	Fresh water fishery

Figure 5: Cultural Ecological Profile of the Chiangmai Basin

rice producing area, that is na or rice field, falls into two categories according to peasant classifications of topography and vegetation. The flood plain depressions where late varieties with a long maturation period must be planted, are called in Lannathai lǫng while tong, which corresponds to Siamese thung, represents the low terrace or fan on which the early and middle-term varieties are mainly grown.[2] The topographical dichotomy of lǫng and tong also indicates the hydrological characteristics of each unit. The lǫng is backswamp which might have been flooded in former times, and would have formerly received water draining from the neighbouring alluvial fans. However, in order to secure a stable water supply it must also be watered with a fairly large irrigation system from the main channel of the Ping river. On the tong, by contrast, many streams flowing down from the mountains must be utilised as the main water resource for cultivation. Along the narrow tributary valleys of the Ping river, tiny alluvial plains, also called tong, provide a favourable terrain for rice cultivation.

The soil on these landforms is mainly alluvial, and consists of deposits of fine sandy loams, silt loams and clay loams, which are called collectively Chiangmai loams (Pendleton and Sarot, 1960: 21-22; Pendleton, 1962: 80). This soil is widely developed in most intermontane basins and is one of the most productive soils for rice cultivation in Thailand. Low humic soils, which are less fertile, are also found on the terraces in marginal areas of the basins (Kawaguchi and Kyuma, 1969: 28).

In the Chiangmai basin there are undulating or even rolling lands surrounding low terraces and alluvial fans. These rolling lands, occupying a transitional zone between the mountains and terraces,

are composed of pliocene and pleistocene materials with various degrees of weathering (Takaya, 1971b: 378; Scholten, 1974: 28; Credner, 1935: 40-41; Lee, 1923: 3-10). These lands, which correspond to mɵn in Lannathai terminology, are never used in wet-rice cultivation, and in many cases are covered by dry deciduous dipterocarp forest.[3] This type of forest vegetation is mainly developed on the red-yellow podzolic soils with strongly lateritic character, which are dry, poor in nutrients and highly susceptible to erosion (Stamp, 1924; Dudal and Moorman, 1964: 69-71). The dry deciduous dipterocarp forest on the rolling hills or mɵn is customarily called pa pae or simply pae in the Lannathai vernacular (Stott, 1978: 171). For peasants living in the intermontane basins pae on the hills represents not only a particular forest vegetation but also a significant living-space which has long provided timber and other useful forest products.[4] Collection of edible plants, fuel and a variety of raw materials for artifacts constitute an important part of subsistence activities for the peasants of neighbouring villages. The rolling hills surrounding the rice producing lowlands have a relative altitude of 100-150 m above the low and middle terraces, and are gradually transformed to hilly and steep mountainous landforms. The mountainous lands, distinguished from hills or mɵn, are called dɵi in peasant terminology, and are commonly covered by tropical monsoon forest and in higher places by tropical evergreen forest.[5]

Thus the living-space of the intermontaine basins falls largely into three main categories, i.e. the major rice-growing lowlands of tong and lɵng, the surrounding hills mainly covered by pae which produces various necessary resources for subsistence, and the mountainous dɵi. However, most economic activities of rice-growing peasants are confined within the former two, and the steep mountainous terrain

sparsely inhabited by non-Thai tribes remains rather unfamiliar to them. There seems to be a strong distinction in peasant environmental concept between the former two and the mountain (*doi*), which is almost considered as another world, that of *chao doi* (hill tribes). For the peasants, rice cultivation as the main subsistence activity is essentially based on resource utilisation in the lowlands called *tong* and *long*. By contrast with the deltaic environment where wilderness has almost completely disappeared, the subsistence activities in the *pae*, together with fishing, constitute a fairly important element of the peasant economy in this region.

2. Farming Technology

As we have discussed with regards to the wet-rice ecosystem in the previous chapter, the importance of irrigation is one of the most crucial elements of rice farming technology, having a vital effect both ecologically and socio-economically upon the entire process of cultivation. With the relatively high catchment/paddy area ratio and the moderate slope of the lowlands, the Intermontane Basin type of cultivation has developed a traditional gravity irrigation system, known as the *müang fai* system, throughout the region. This highly sophisticated system clearly differs from the system prevalent in the extremely flat delta region where the water supply is mainly dependent on rainfall and on annual inundation. The *müang fai* system is essentially a gravitational irrigation complex in which the natural flow of a river is held back at an artificial *fai* (weir) and thence allocated through regular networks of excavated canals or *müang* into the rice fields by gravity (Credner, 1935: 183, 215; Wongsanupraphat, 1941: 290).

The water taken off at the intake (pak müang) flows down in the müang, which is usually an artificial modification of a natural stream. It branches off at smaller sluice gates or tae, installed in the müang, to secondary and tertiary channels (müang soi) which are provided with turnout gates or tang for further allocation in the terminal networks. From the tang the water conveyed in the networks flows into the individual plots through farm turnouts called pak tang nam. In the individual plot, consisting of several fields, a peasant may retain the level of water in each strip by surrounding it with relatively high dikes (khan nam) in which bamboo tube offtakes (thǫ nam) are buried to regulate the water level between fields. Müang fai irrigation is thus a skilfully designed system from water input at the fai through to distribution by terminal networks. The farming system which has been established within the intermontane basins depends upon this tremendously well organised system of water utilisation. The existence of such systems and associated customs is also recorded outside Thailand especially in Sipsǫng Panna of Yunnan (China), the Shan States of Burma, the Tonkin Hills of Vietnam, and in Laos.[6] This implies that a farming system essentially similar to müang fai is widely distributed among Thai-speaking peasants and tribal people in intermontane basins and mountain valleys throughout the northern part of mainland South East Asia.

According to government irrigation policy most müang fai systems have been placed since the 1930's under the jurisdiction of the Royal Irrigation Department (RID).[7] The numerous smaller systems developed by peasant co-operation over long periods are primarily left to the traditional irrigation control groups under the category of a People's Irrigation Project (khrongkan chonprathan rat). But the RID, in principle,

provides subsidies and engineering support where needed to some of these projects. On the other hand, most existing large systems have been improved and directly controlled as State Irrigation Projects (khrongkan chonprathan luang) by the RID. In the major intermontane basins, i.e. Chiangmai, Lampang, Chiangrai, Phrae and Nan in 1974, some 789,900 rai (126,384 ha) of land were occupied by seven State Irrigation Projects, mostly with integrated-headworks installations (Thailand-Royal Irrigation Department, 1975: 1-5). On the other hand, smaller traditional systems, including those registered as the People's Irrigation Projects, cover a considerably larger area probably amounting to nearly 1.5 million rai (240,000 ha) in the whole region.[8] Table 4 shows irrigation projects and the areas irrigated by them in Chaiangmai and Lamphun provinces. The four state projects, amounting to 322,900 rai (51,664 ha) cover the greater part of the Chiangmai basin which extends to Lamphun province in the south. However, it should be noted that the area traditionally served by the People's Irrigation Projects is quite large, amounting to about 0.7 million rai (2,009 smaller systems) in the two provinces. In Chiangmai province in 1973, the irrigated area of the modern systems accounted for 34.2 per cent, and that of the traditional smaller systems for 57.8 per cent of the total cultivated area of 935,512 rai. The traditionally developed müang fai systems are still widely operational and predominate especially in marginal areas, even in Chiangmai province where the modern state projects have progressed markedly during the past few decades.

Apart from the official classification of irrigation projects, the müang fai systems in the Chiangmai basin can be interpreted in terms of three main types according to the size of irrigable area, a division which may have socio-economic implications (Figures 4 and 6).

TABLE 4: Irrigation Projects in the Chiangmai Basin

Category	Project	Province	Construction year started, completed	Irrigated area (rai)	(ha)
State Irrigation Project	Mae Faek	Chiangmai	1928-1936	70,000	11,200
	Mae Ping Kao	Chiangmai and Lamphun	1937-1941	44,900	7,184
	Mae Kwang	Chiangmai	1948-1954	60,000	9,600
	Mae Taeng	Chiangmai	1963-1972	148,000	23,680
Total				322,900	51,664
People's Irrigation Project	2,009 projects	Chiangmai and Lamphun	-1975	705,478	112,876
Sum total				1,028,378	164,540

Source: Thailand-Royal Irrigation Department, 1972: 1-2, and personal communication with Chonprathan dan Phayap, Royal Irrigation Department, 1975.

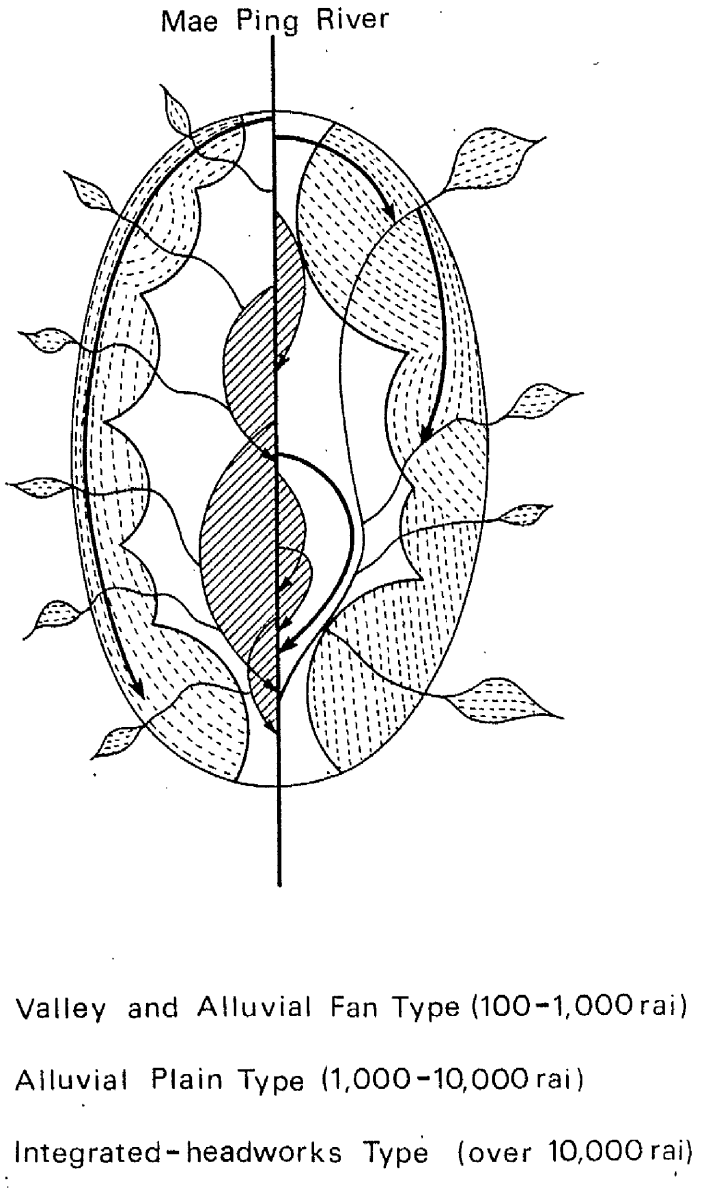


Figure 6: Three Types of Müang Fai Irrigation System in the Chiangmai Basin

These are the valley and alluvial fan type, the alluvial plain type, and the integrated-headworks type, which are diagrammatically shown in Figure 6. The People's Irrigation Projects mainly include the former two types, while the State Irrigation Projects consist of all the large projects of the Integrated-headworks type and some of the Alluvial Plain type. The first type consists of small-scale projects that have been traditionally constructed in tributary valleys and marginal fans surrounding the alluvial plain of a basin. The foundations of traditional fai are mainly constructed of readily available materials, such as combinations of wood stakes, brushwood, rubble and earth. From an engineering point of view, most of these are constructed as temporary and low-durability structures. Thus, after supplying a steady flow of water through the take-off canals for the early stages of the main season rice cultivation, in particular for the transplanting period, the fai are normally subject to considerable damage, which leads to their being washed away by any significant rise in the river's water level from July onward (Graham, 1924: II, 24). Because rainfall provides, thereafter, a relatively good water supply, and because risen water can easily flow into the take-off channel, the fai is no longer necessary until the following year. Thus, in the Valley and Fan type of müang fai system, the use of temporary structures necessitates annual repairs to the damaged fai and dredging of the canals.

With such structures, the irrigable area covered by this type extends approximately from 100 to 1,000 rai. In many cases, this small scale system is operated and maintained by the co-operative efforts of those who benefit by it, and usually provides irrigation water to the fields within one or several villages. Because of the necessarily close co-operation in the running and maintenance of the system, the

peasants who are water users are traditionally organised into an irrigation control group or mu fai,[9] under the leadership of an irrigation headman or kae müang, sometimes called huana müang fai. Annual repairs to the system require a massive input of labour and materials, and water allocation into the members' plots is performed through the close co-operation of the mu fai.

The second type of müang fai system has been developed on fairly open terrain in the central part of the basin. Its irrigable area typically extends to over 1,000 rai and some systems can possibly water more than 10,000 rai. In many systems of this type, the water is taken into the intake at the larger fai installed across the main channel of the Ping river or at the apex of the larger alluvial fans. The weirs are mostly more durable structures with jungle posts of solid wood and rocks.[10] Although this type is more durable and permanent in structure, it is often damaged by floods and consequently requires repairs as in the case of the smaller system. Within the larger area also, the system is operated and maintained by larger mu fai in which many villages are involved. As is the case in the smaller systems, the facilities of the larger systems are regarded as public property and managed through the close co-operation of mu fai members. In some of the biggest systems, a kae luang (great chief) is elected for co-ordination among kae müang who are in charge of the smaller units. The actual maintenance can usually be performed within such smaller units.

The third type of irrigation is a much improved system receiving an abundant water supply from large integrated headworks (Figure 4). The unstable condition of the traditional müang fai system generally occurs when the expansion of the cultivated area exceeds the water

supply capacity of the system. When this happens, water shortages and disputes within the mu fai, in particular between upstream and downstream, frequently occur. The situation can only be overcome technologically, and is normally resolved by the installation of integrated headworks at a site from where a sufficient amount of water can be taken into a newly excavated trunk canal. Using a single headworks, a new trunk canal can feed an area of several former systems by utilising their existing terminal networks. The irrigable area of the integrated-headworks system, in which the former independent systems are incorporated, usually amounts to more than 10,000 rai. The construction of such a system, which entails very considerable cost and labour input, is normally achieved in current circumstances by the government as a State Irrigation Project. The RID has direct charge of the operation and maintenance of such systems. However, the maintenance of lateral canals and terminal networks, in many cases, remains based on existing co-operative schemes which have been effectively practised as traditional mu fai.[11]

Although these three types of müang fai system can be thus classified according to the size of irrigable area, the engineering principles involved are quite similar in that they are all gravitational irrigation systems which are adapted to the topographical and hydrographical conditions of the intermontane basins. In the traditional Valley and Fan type and the Alluvial Plain type, the peasant co-operative scheme of mu fai is crucial and must function efficiently to supply labour maintenance materials. Especially in the former system, success of cultivation is absolutely dependent upon annual repairs. Even in the modern integrated-headworks system, indispensable routine tasks are fundamentally required of each of the smaller constituent units.

For many centuries, the highly sophisticated engineering of the müang fai system has provided the core technology of the Intermontane Basin type of rice cultivation. Such physical systems have enabled this region to secure more stable production and higher land productivity than elsewhere in Thailand. Successful operation of the müang fai system also depends, however, on the efficiency of social organisation to control the system as well as on the physical system itself. It is particularly important to realise that a müang fai system, particularly a traditional one, can be worked effectively only when the social organisation fulfils certain functions in the operation and maintenance of the physical irrigation system.[12] The peasant co-operative scheme of mu fai with its traditional order and customs relating to making repairs to the facilities and water allocation, is of fundamental significance in the farming system of the intermontane basins, as will be shown in a later chapter. This point emerges more clearly when comparisons are made with the irrigation in the Delta type of cultivation.

Depending as it does on the well-developed müang fai irrigation systems, farming technique in the region is almost exclusively characterised by the transplanting method which basically requires a stable and ample water supply during the first half of the cultivation period. This method of cultivation is called in Lannathai puk (planting or transplanting), corresponding to pak dam or dam in Siamese, which appears to refer only to the transplanting operation itself. For most peasants, however, it implies not only the transplanting operation, but also the entire process and conditions which enable them to accomplish such a crucial operation, puk.

In the course of transplanting cultivation there is a series of crucially important farming stages which characterise the Intermontane

Basin rice farming. The first is land preparation consisting of ploughing, harrowing and levelling, which are still mainly performed by utilising draught buffalo and traditional wooden implements with some metal parts. Secondly, highly elaborate techniques in nursery culture are widely practised throughout the region with a stable water supply. Thirdly, uprooting of seedlings and their transplanting take place during a limited time in a highly skilled manner. Although there are several other necessary farming stages prior to harvesting and other final operations, the three specific operations outlined above with their extreme sophistication seem to be the main characteristics which distinguish this type of cultivation from broadcast-sowing methods and even from transplanting methods practised in other regions. All these major operations which require great care and close water control in the operating plot can be accomplished successfully only by means of a well-maintained müang fai system.

Throughout the farming operations, and especially as regards the tasks which inevitably accompany irrigation, transplanting cultivation is quite labour-intensive. Putting aside the co-operative within the traditional mu fai organisation, the labour required at each stage of cultivation is primarily supplied from the domestic labour force of the farm household. However, outside labour resources such as traditional co-operative labour and wage labour are normally mobilised during the two peak periods of intensive labour demand, which, in the case of the transplanting culture, occur at uprooting-transplanting and harvest time. Generally speaking, in contrast to the Delta farming region, utilisation of co-operative labour still performs a sighificant function in completing such hectic operations, though this has been substituted partly by wage labour in recent years. It can be thus assumed that the Intermontane Basin

farming system has been founded on the highly labour-intensive transplanting method which can be achieved through the long-established müang fai irrigation system.

The area of transplanted field, officially classified by the government under the term na dam in Siamese, is overwhelmingly predominant in the seven northern provinces, and accounted for more than 98 per cent of the total area under rice cultivation in the 1950's and 1960's (Thailand-Ministry of Agriculture, 1968: 64). This predominance of na dam, or na puk in the Lannathai language, is thought not to have changed throughout the 1970's, so far as Chiangmai province is concerned.[13] The remaining area, which is often officially classified as broadcast-sown field (na wan), is actually cultivated not by the methods practised in the deltaic environment but by a sort of swidden method which is usually applied in the upland or even in the marginal areas of the lowlands during the initial stage of reclamation.[14] According to the Lannathai peasant perception of riceland, all the rice fields should be transplanted fields simply called na or na puk, to which the swidden field, na hai or simply hai is the opposite. Until recent years when opportunities for lowland reclamation almost disappeared, and apart from the swidden on the upland hills which are scattered in the pae, most lowland hai used to represent a transitional stage which would eventually evolve into na puk (na dam) with adequate irrigation facilities. The transplanting culture apparently seems to be a fundamental attribute of the farming technology in the intermontane basins, and for the peasants, every rice field must be continuously improved with an artificial water supply in attempts to attain the ideal transplanted field.

Another striking feature of the agricultural land-use of this region is the fact that about 80 to 90 per cent of the total rice planted area is devoted to glutinous rice cultivation, with an exception of less than 50 per cent in Mae Hongson province (Thailand-Ministry of Agriculture, 1968: 69,73). The predominance of glutinous rice cultivation is a feature which the region shares with most parts of northeast Thailand, and the region in fact constitutes a southern part of the glutinous rice zone stretching from southwest China over mainland South East Asia.[15] In the 1960's the planted area and production of glutinous rice accounted for about 90 per cent of the respective totals in the region (Watabe, 1967: 9-11). In Chiangmai province, however, as shown in Table 5, despite the expansion of the total paddy area, neither the area nor the production of glutinous rice are very high, and production stands at about 80 per cent of the total, while the production of non-glutinous rice has shown a steady rise in recent years. This is mainly because there has been a growing demand for non-glutinous rice among the urban population, though most peasants in rural areas still exhibit a strong preference for the sticky texture of glutinous rice. Be that as it may, the agriculture of the intermontane basins is still considerably concentrated on glutinous rice cultivation, by contrast with the Chao Phraya delta where non-glutinous rice dominates both production and consumption.

The rice cultivation in the region has long gained the reputation of a higher average yield per unit area. During the recent five years (1973-77) the region has recorded an average of 45.2 thang per rai (2.8 tonnes/ha), which is considerably higher than that of the Delta farming region and of the country as a whole, as is shown in Table 6. In particular, Chiangmai, Chiangrai, Phrae and Nan have maintained quite

TABLE 5: Planted Area, Production and Yield of Glutinous and Non-Glutinous Rice in Chiangmai Province, 1961-1974

Year	Total Paddy area (rai)	Planted area (rai)		Production (kwian)		Yield (thang/rai)	
		Glutinous (%)	Non-glut. (%)	Glutinous (%)	Non-glut. (%)	Glutinous	Non-glut.
1961*	630,663	547,091 (85.1)	95,793 (14.9)	200,685 (84.3)	37,402 (15.7)	36.7	39.0
1965**	621,610	562,649 (88.1)	75,744 (11.9)	242,369 (89.1)	29,704 (10.9)	43.1	39.2
1972	655,905	516,616 (79.4)	133,956 (20.6)	234,210 (80.5)	56,831 (19.5)	45.3	42.4
1973	689,305	532,608 (78.3)	148,037 (21.7)	210,932 (76.7)	64,050 (23.3)	39.6	43.3
1974	706,010	568,807 (80.7)	135,803 (19.3)	294,722 (81.8)	65,703 (18.2)	51.8	48.4

* Including off-season and upland cropping

** Including off-season cropping

kwian = 100 thang or 2,000 litres, 1,010 kg

thang = 20 litres, 10.1 kg

Source: Thailand-Ministry of Agriculture, 1963: 22, 32, 48; Thailand-Ministry of Agriculture, 1968: 56, 73, 90; Personal communication with Chiangmai Provincial Office, 1975.

TABLE 6: Average Yield in the Intermontane Basin Farming Region

Province	Average yield, thang/rai	1973-1979 tonne/ha
Chiangmai	47.0	3.0
Chiangrai	46.6	2.9
Lamphun	36.9	2.3
Lampang	40.6	2.6
Phrae	47.8	3.0
Nan	44.8	2.8
Mae Hongson	41.1	2.6
Total	45.2	2.8
Total in the Delta	32.7	2.1
Total in the whole country	25.7	1.6

Source: Thailand-Ministry of Agriculture, 1978: 16-21.

high and stable yields in recent years. It is considered that several factors have contributed to maintaining relatively high yields in this region, but there is little doubt that the highly productive soils developed in most areas of the region have been important causes of the high yields. It should be noted, however, that in addition to this purely natural condition, the indigenous establishment and wide prevalence of müang fai systems have been providing basic grounds for the stability of rice farming. The highly sophisticated techniques of the transplanting culture founded on the traditional systems must be a contributory factor. It may also be true that the government irrigation projects carried out in recent years, contribute, to a certain degree, to raising the yields in the Intermontane Basin farming region.

3. Socio-economic Conditions

(1) Peasant Farming as Subsistence Production

Table 7 shows some basic farming data for seven provinces in which the Intermontane Basin type of rice farming is predominant. The average farm size (area operated) in this region is relatively small, amounting to 6.3 rai (1.0 ha) or about a quarter of that in the delta region. Although the farm size varies significantly from village to village and within each village according to ecological and socio-economic factors, some recent community studies also give similar figures in Chiangmai basin: 6.6 rai in Ku Daeng, Saraphi district and about 5 rai in a village in Mae Taeng district (Kingshill, 1976: 31; Wijeyewardene, 1967: 77, 79). Zimmerman's survey of ten villages in this region shows an average farm size of 10.6 rai in the early 1930's, and it is apparent from this that peasants cultivated a much larger area some fifty years ago (Zimmerman, 1931: 25-28). Fragmentation of holdings

TABLE 7 : Estimated Average Area Operated and Gross Product per Household in the Intermontane Basin Farming Region

Province	No. of rice farming households 1968	Estimated No. of rice farming households 1977*	Average size of farm household 1970 (persons)	Average operated area/ household 1973-77 (rai)	Average gross product/ household 1973-77 (thang)
Chiangmai	94,477	121,592	5.0	5.6	261
Chiangrai	119,387	153,651	5.4	9.2	431
Lamphun	33,325	42,889	5.4	4.6	168
Lampang	70,572	90,826	5.5	4.2	171
Phrae	43,996	56,623	5.6	4.4	212
Nan	30,247	38,929	5.6	6.0	270
Mae Hongson	10,142	13,053	5.0	6.7	276
Total	402,146	517,563	5.4	6.3	284
Total in the Delta	340,441	438,150		22.2	724
Total in the whole country	2,766,932	3,561,041		14.4	369

* The number of rice farming households in 1977 is estimated by the equation

$$N = Y \cdot c^{r(X)}$$

where N = The number of rice farming households in 1977
Y = The number of rice farming households in 1968
c = 2.718
r = The ratio of population growth : 0.028
X = The number of years : 9 years.

This equation follows that of the Agricultural Land Reform Office, Thailand in estimation of the number of households in 1976. See Thailand-Agricultural Land Reform Office, 1976: 11.

Source: Thailand-National Statistical Office, 1969: 49-50; Thailand-National Statistical Office, 1970b; Thailand-Ministry of Agriculture, 1978: 14-21.

through the persistence of inheritance customs and a rise in the number of farming households over the last five decades have probably caused this reduction in the size of holding. Since a holding is normally divided into smaller parcels by dikes to keep standing water on the levelled floors of the fields, there is always the possibility that each small parcel of land can be operated separately. Therefore fragmentation, or more precisely the subdivision of the holding, may well have proceeded without any serious loss of technological efficiency, and the labour-intensive character could be further stimulated by a subdivided smaller plot, as Farmer suggests in general terms (Farmer, 1960: 229-230). Subdivision seems to have been accelerated by the inheritance customs among peasants, which stress equal division of inheritance among the children. Moreover it must be borne in mind that there has been a steady reduction in the area of wilderness available for clearance and during the past few decades, indeed, waste land has almost disappeared.

With the relatively high yield per unit area and smaller farm size, the peasants produce some 280 thang (2.8 tonnes) of paddy per household on average. According to the 1963 Household Expenditure Survey, the per capita yearly consumption of milled rice in rural areas is 185.5 kg in this region (Thailand-National Statistical Office, 1964: 7, Table 1). Taking into account the average population per farming household (5.4 persons/household) and the milling ratio of paddy (60 per cent),[16] the necessary paddy equivalent for yearly consumption per household can be estimated at about 166 thang, which accounts for 67 per cent of the average gross product of the region (Table 8). When the farm operating costs including seeds, draught animals, cash outlay for hired labour and purchased input, and the cost assigned to domestic labour are deducted from the gross production, the average farm size

TABLE 8: Annual Household Paddy Consumption Requirements

	Intermontane Basins	Chao Phraya Delta
Milled rice consumption per capita per year*	185.5 kg	166.7 kg
Milling ratio**	60%	60%
Paddy equivalent	309.2 kg (c. 31 thang)	277.8 kg (c. 28 thang)
Average size of farm household	5.4 persons	5.9 persons
Necessary paddy per household	1,669.7 kg (c. 166 thang)	1,639.0 kg (c. 163 thang)

* The figures represent the amount of milled rice consumption in the rural area of the Northern and Central regions in the 1963 Household Expenditure Survey.

** The small rice mills in the rural area of both regions do not achieve such a high ratio as 65%. For the case of North-east Thailand, see Dixon, 1974: 3.

Source: Thailand-National Statistical Office, 1964: 7, table 1.

is unlikely to bring a return large enough to meet household expenditure for consumption.[17] Moreover, since interest, tax and land rent amount to nearly a half of the gross product, tenants with the average operating farm size obviously bear heavy deficits, and even full owners are unlikely to secure the minimum subsistence level of living from rice cultivation alone. It should also be noticed that the average figures of the provinces such as Lamphun, Lampang and Phrae indicate an even worse situation.

It is quite difficult to estimate a viable farm size that is just sufficient to maintain the minimum subsistence level of living only by rice farming.[18] In estimating the size it would be necessary to take into account not only production costs and the necessary household expenditure but also various fluctuations in, for example, farm gate paddy prices and yields. In 1974 a source gave 15 rai as a standard economically viable size in the region (Peerathep, 1974: 7), but the necessary minimum size must be lower. For a village in Chiangrai province in the early 1970's Turton recognised that "holdings of rice land below 11 rai were unlikely to yield a surplus above subsistence needs" (Turton, 1978: 110; Turton, 1976: 294). In a double cropping village within the Saraphi district of Chiangmai, the average household required about 5 rai to make a living in 1972 (Potter, 1976: 56). It seems reasonable to consider that a peasant with about 10 rai under full ownership could feed his family by assignment of the greater part of his product to home consumption including food and miscellaneous purposes, and a part of production costs to be paid in kind.[19] The somewhat smaller proportion remaining would be put onto the market for cash expenditure. Be that as it may, it seems clear that the peasants in the region have the primary intention of securing paddy for home

consumption by utilising relatively small holdings with labour-intensive technology.

Under the strong orientation towards subsistence farming, every peasant knows how much land and harvest are necessary to keep his family alive at the minimum level. Although no peasants in the region seem to deliberately consider or calculate the return to family labour, land and capital, there are certainly traditional expectations that the minimum subsistence will be achieved (Gudeman, 1978: 76-77). According to the author's survey in a village within Chiangmai province in 1975, there is a certain range of socially expected farm size, varying from about 8 to 10 rai for a family household which is supposed to be composed of five members, though the actual average is 4.1 persons per household. In reckoning the rice production economy under the expected size of land, most of the villagers usually take into account the volume of the expected harvest, assuming possible fluctuations in average yield per rai, the size of home consumption and the possible production cost which is to be paid in kind, excluding cash outlay, before storing the harvest in the granary. All these considerations are made basically on a non-monetary basis, and the economic calculations of cash income and expenditure tend to be shrouded in obscurity (Table 9).

Among the village peasants there seems to be a certain amount of unhusked paddy needed for home consumption called khao kepwai kin (paddy for home consumption), which in many cases is said to be about 45 thang (9,000 litres or 450 kg)[20] per person per annum. The concept of khao kepwai kin is not only confined to the necessary amount of paddy for food but also includes additional paddy which is socially desirable to make a living in village society; this is primarily for the purposes of occasional barter to exchange it for necessary goods such as poultry,

TABLE 9: Rice Production Economy in Chiangmai Village on the Basis of Socially Expected Farm Size, 1975

Expected Farm Size	8 rai	10 rai
Total gross product		
Yield: 50 thang/rai	400.0	500.0
55 thang/rai	440.0	550.0
60 thang/rai	480.0	600.0
Khao kepwai kin*	222.5	222.5
(Paddy for home consumption)		
Food**	167.5	167.5
Contribution to wat	10.0	10.0
Barter	20.0	20.0
Reserve	25.0	25.0
Production cost in kind	88.0	106.5
Seed	4.0	5.0
Buffalo rental	48.0	60.0
Hired labour	35.0	40.0
Irrigation fee	1.0	1.0
Total non-sale disposal	310.5	329.0
Possible amount for sale and other purposes		
Yield: 50 thang/rai	89.5 (22.4%)	171.0 (34.2%)
55 thang/rai	129.5 (29.4%)	221.0 (40.2%)
60 thang/rai	169.5 (35.3%)	271.0 (45.2%)

* The calculation is based on the assumption that a household consists of five persons.

** The paddy consumption per capita per year in the surveyed village is 337.9 kg (c. 33.5 thang), the milled rice consumption being 1.1 litres per capita per day. These figures are a bit higher than those in the 1963 Household Expenditure Survey. See Table 8.

Source: 1974-75 Survey.

fish and handicrafts, and more significantly for contribution to the Buddhist temple (wat) for gaining merit (tham bun). Moreover, if there were any kinsman unable to earn a livelihood, a peasant might be expected to support him by some contribution of extra paddy. Until some thirty years ago the necessary amount of khao kepwai kin seems likely to have been a little higher than that required at present, as a result of more frequent opportunities for non-monetary exchange in the countryside at that time. Be that as it may, the village peasant can dispose of the remaining paddy on the market only after securing the economically and socially required subsistence level. In cultivating 8 to 10 rai, the possible amount for sale varies considerably from 22 per cent to 45 per cent of the total output according to the yield level. The sales, equivalent to between 1,500 and 4,600 baht at the price level of 17 baht per thang in 1975, would be assigned to some cash payment for hired labour and some purchased input, but largely to expenditure for domestic consumption, and more likely to pay off debts. The objective of such farming is thought to be not entrepreneurial profit but basically to secure domestic consumption.

However, owing to the deterioration of land tenure and the continuing subdivision of holdings, it has become increasingly difficult for the majority of peasants to secure a sufficient amount of paddy for home consumption by cultivating their small-holding or rented land. Growing of cash crops such as tobacco, soyabeans and other vegetables has come to perform an increasingly significant role for most peasant households in order to obtain cash income to meet increasing expenditure in domestic consumption. Moreover, there has been in recent years a growing number of households who have to depend upon non-farm activities, particularly wage labouring. On the other hand, there has been a rather

small number of households who own sufficient land, probably more than 20 rai, through small-scale and gradual accumulation over many years. Some of them have become petty landlords who remain within subsistence farming renting out all or a part of their holdings, while others have begun to find their way out of subsistence farming.

(2) Development of Tenancy

Few scholars have paid attention to tenancy and its associated land tenure problems in the intermontane basins. This is partly because of the comparatively lower ratio of rented land to the total landholdings than in the Delta region. As shown in Table 10, the figures for most provinces except Chiangmai are lower than those of the delta in both ratios of rented land and households who rent the land (tenants and part-tenants). The regional average of rented land in 1973, amounting to 16.33 per cent, is quite low, and even the highest ratio of 35.13 per cent in Chiangmai province is still lower than the regional average in the delta (38.35 per cent). However, it should be noted that these average figures for each province hardly suffice to illustrate the extent to which tenancy varies from area to area and from village to village. Regional variation and uneven development are essential concomitants of tenancy in under-developed agrarian societies. Since there are no reliable data showing systematically the land tenure situation in lower administrative units in this region, we have to infer the current situation from small-scale surveys.

For the central part of the Chiangmai basin, Kingshill has stressed the predominance of smallholders in Ku Daeng (Saraphi district) in 1954, but he has also indicated the existence of absentee landlords living in Chiangmai city area who own considerable amounts of land in

TABLE 10: Area under Tenancy and Number of Tenants and Part Tenants in the Intermontane Basins

Province	Area under tenure, 1973 rai	Area under tenancy 1973		No. of farm households* 1976	No. of tenants and part tenants*	
		rai	(% 1973)		1976	(% 1973/4)
Chiangmai	1,005,468	353,221	(35.13)	137,556	54,225	(39.42)
Chiangrai	2,115,625	251,548	(11.89)	169,751	32,745	(19.29)
Lamphun	310,902	59,988	(19.29)	47,904	14,754	(30.80)
Lampang	976,875	85,770	(8.78)	86,008	12,187	(14.17)
Phrae	487,863	80,446	(16.48)	53,831	12,317	(22.88)
Nan	482,866	38,146	(7.90)	49,157	7,300	(14.85)
Mae Hongson	129,014	30,576	(23.70)	16,186	4,008	(24.76)
Total	5,508,613	899,695	(16.33)	560,393	137,536	(24.54)
Total of the Delta region	16,287,781	6,246,589	(38.35)	525,310	257,383	(49.00)
Total of the whole country	112,753,578	13,834,225	(12.27)	4,379,543	912,858	(20.84)

* Figures estimated from the 1970 Population Census by the Agricultural Land Reform Office.

Source: Thailand-Ministry of Agriculture, 1975: 5-9; Thailand-Agricultural Land Reform Office, 1977: 6-10.

other parts of the district (Kingshill, 1976: 29-33). According to D.H. Bau's survey in 1949, forty per cent of all land was rented, and fifty one percent of the total operating households were tenants or part-tenants in the same district (Bau, 1951; Pringle et al.,1952: 3, Appendix B). Tomosugi's survey in San Kaptong of the same district in 1962 points out the prevalence of tenancy under petty landlords living within the village and extremely small holdings of owner-operators and part tenants (Tomosugi, 1969: 167-170). Potter's more recent survey in a village of the same district in 1972 shows that about 71 per cent of 206 households own less than 5 rai and the existence of intricate smallscale landlord-tenant relationships within the village (Potter, 1976: 56-58). According to a survey of 22 villages in the Chiangmai basin in 1972/3, only 36.1 per cent of the 440 sample households owned all the land they farmed, while 63.9 per cent were tenants or part tenants (Benchavan et al.,1974). These are case studies undertaken in the central part of the fertile alluvial plain south of the Chiangmai city area, but tenancy and landlessness seem to have become more prevalent even in the marginal areas of the basin in the 1960's, as Wijeyawardene points out in a village of Mae Taeng district north of the Chiangmai city area (Wijeyewardene, 1967: 77). On the other hand, in most tributary valleys far away from the major cities and some provinces such as Lampang and Nan, where land hunger is far less of a problem, and where the money economy is still undeveloped, there is, of course, a predominance of owner operators. Thus, in Ban Ping, within the Chiangkham district of Chiangrai province, where land reclamation was still taking place in 1960, land was often rented outside villages. Within the village only 5 per cent of cultivators were tenants, many of whom were kinsmen of landlords (Moerman, 1968: 101, 113).

Despite the inadequacy of the sources, it seems that tenancy has prevailed significantly especially in the major basins such as Chiangmai-Lamphun during the past two decades, while cultivation by owner operators of smallholdings has still remained predominant in many other parts of the region. This partially coincides with the government's land reform programme (1977-1981), which has laid emphasis upon the proposed reform of privately-owned land in Chiangmai and Chiangrai provinces in this region (Krirkkiat, 1978: 184-185). Particularly in the central part of the Chiangmai basin where the economy is becoming increasingly monetised, it may be easily supposed that more than a half of the total agricultural land is under tenancy and the proportion of tenants and part tenants exceeds 60 per cent of the total number of farming households.[21]

Generally speaking, tenancy within this region seems to be characterised by a great deal of small-scale renting by petty landlords living in villages together with renting by absentee landlords who are resident in provincial or district towns and who are usually moneylenders. Although there are few statistical data relating to tenancy relationships, a number of village studies suggest the predominance of small-scale renting between petty landlords owning holdings of 10 to 50 rai and tenants living in the same or nearby village. These petty landlords who rent land to tenants and part tenants participate in farming themselves in many cases and sometimes they rent out all their holdings when they reach old age or are unable to continue work on them. Such small-scale renting also often occurs in extremely small or distant holdings resulting from repeated subdivision and fragmentation over the years (Turton, 1978: 113). It should be particularly noted that among these cases of small-scale renting there can often be found many cases

of renting among kinsmen, especially between parents and their sons and daughters. Although such renting forms a landlord-tenant relationship in payment of land rent identical to that practised between non-kinsmen, the son or daughter as a tenant cultivates the land in the hope that in the future it will be inherited from the parents. This type of renting, particularly characteristic of the intermontane basins, seems to be related closely to a certain pattern of allocation of land and labour within the peasant household.[22] The renting between parents and their independent progeny or close relatives is apparently a sort of non-market relationship rather than a purely commercial transaction, so that it is called by Moerman 'kinship disguised as commerce' (Moerman, 1968: 113). However, this is the case in rather remote frontiers and in earlier periods, probably until the mid-1960's. In the author's study village and elsewhere in Chiangmai province the rent to be paid in kind to parents' households traditionally called kha hua na or simply kha hua (nominal token) was approximately 10-20 per cent and 30 per cent at the highest up to the mid-1960's (Tanabe, 1976: 707). But since then, it has risen to almost a half of the gross production identical to that levied on non-kinsmen in many localities throughout the central part of the Chiangmai basin. Thus it can be said that the non-nominal and substantial rent relationship has become prevalent even between kinsmen in recent years.[23]

The land resources owned by petty local landlords and owner-operators are in many cases derived from inheritance, purchasing and the small-scale reclamation or chap chong[24] which has continuously taken place from ancient times up to recent years. On the other hand, accumulation of holdings by absentee landlords who own more than 50 rai but mainly over 100 rai seems to have been attained through foreclosing

mortages and purchasing holdings of heavily indebted smallholders. It is considered that the accumulation of holdings in these ways has proceeded steadily throughout the past two decades. Compared with the situation in the delta, however, the magnitude of accumulation by the absentee landlords in this region is relatively small, especially as regards rice fields,[25] and large-scale holdings over 1,000 rai are also scarce. In contrast to the delta where large-scale reclamation proceeded rapidly between the close of the nineteenth and the early twentieth centuries, the intermontane basins far north from Bangkok did not undergo such an expansion of rice land to increase commodity rice production in those periods. Throughout history gradual and small-scale reclamation by individual peasant households has always been predominant and large-scale reclamation has been rather sluggish.

However, this does not mean that there have been no big absentee landlords who have accumulated large quantities of land through reclamation. Some members of the royal family and noble officials who were descendants of the Chiangmai court or provincial governors[26] seem to have been able to obtain a substantial increase in the amount of land through private enterprise by way of large müang fai systems. Between 1910 and 1920, for example, Chao Ratphakhinai, a member of the Chiangmai court, carried out at least two fairly large-scale irrigation projects in the Sanpatong and Sankamphaeng districts of Chiangmai, to reclaim the wasteland and to establish ownership along the newly built canal, as well as to collect irrigation fees (Prani, 1963: Vol.2, 295; Tanabe 1979a: 15-16). In the 1930's, Zimmerman recorded a vast holding of over 1,000 rai owned by an absentee landlord in a village within Sankamphaeng district (Zimmerman, 1931: 25-28). Whatever the case, there seem to be some large-scale properties which belonged to the old

aristocracy and which were supposed to have been reclaimed during the periods of the 1910's and 1920's, which have still remained under cultivation by many tenants up to the present in the main intermontane basins, particularly in Chiangmai. It should be noted that the large-scale accumulation of rice fields in this region has been comparatively underdeveloped owing to the general tendency of the peasant economy towards subsistence.

The most popular form of tenancy prevailing throughout the region is sharecropping, whether land is rented from absentee landlords or from local petty landlords. Although fixed rents in kind and in cash are also known in the region, they still remain unrepresentative. Sharecropping is commonly termed among peasants yia na pha koeng (rice cultivation dividing half), or as Turton has cited yia baeng koeng (work dividing half), and its land rent is called kha pha koeng (rent of a half) (Turton, 1978: 113). Although the rent varies according to the locality, the standard rate under sharecropping is a half of the paddy harvested. In many areas, only the necessary seeds and the rental of the buffalo, among the various items of production cost, are in principal shared equally between the landlord and tenant. Therefore, when a buffalo is hired for land preparation, the land rent would be a half of the harvest after deducting the buffalo rental, which roughly accounts for 40 to 45 per cent of the gross product. Sharecropping with a rent of a third and two-fifths has also been widely observed (Moerman, 1968: 110-111), but there are few records of rents exceeding 50 per cent of the gross product. In general the rate amounting to 40 to 50 per cent under sharecropping tends to be higher than that of the fixed rent in kind commonly practised in the delta region. However, in sharecropping the landlord and tenant share the risks of yield

fluctuation: even in cases of heavy crop failure the sharecropping tenant can secure some proportion of the small harvest, while the tenant paying a fixed rent obtains nothing if the landlord expropriates all the harvest as the fixed rent; conversely a good harvest may provide the maximisation of profit for the latter, and a somewhat smaller profit for the former.[27] In this sense sharecropping may be preferable, albeit at the expense of a heavy rent in normal years, for most subsistence peasants who tend to prefer the maximisation of security and survival to profit maximisation. It can be considered that the predominance of sharecropping is associated closely with peasant attitudes in the context of the strong orientation towards subsistence farming in this region.

Increasing fragmentation of smallholdings and widespread prevalence of tenancy, causing reduction of output per household under subsistence requirements, indicate that a substantial proportion of peasant households has to seek cash income from supplementary occupations. Although where local conditions allow, there has been some development in the growing of dry-season cash crops such as tobacco, soybeans, sugar cane and other vegetables, the main supplementary income source comes from non-farm activities and especially from wage labouring. With the exception of petty local landlords and owner-operators who have sufficiently large holdings, most smallholders and tenants operating farms below a viable size must obtain supplementary income from wage labouring in agricultural and non-agricultural sectors.

In addition to these operating farm households there seems to be a considerable growth in the number of landless rural labourers who earn their livelihood mainly from wage labouring. Little is known with respect to the existence and magnitude of these landless rural labourers

in the region. Although the 1963 Agricultural Census gives about sixty thousand families of landless labourers in the whole country, this figure is thought to be far from accurate (Fuhs and Vinggerhoets, 1972: 40-41; Turton, 1978: 112). According to some village studies in Chiangmai province, in Mae Taeng district in 1964 half of the total households of a village were landless, while in 1972 in Saraphi district, one out of every three households of a village were rural labourers (Wijeyewardene, 1967: 77; Potter, 1976: 56). For a district in Chiangmai province in 1974, Turton found 36 per cent of households landless out of 1,488 households (Turton, 1978: 112). In recent years it seems reasonable to assume that nearly 30 per cent of the total households in the average village (excluding non-farm households such as shopkeepers, officials and salaried employees) might be landless rural labourers, at least in the central part of major basins such as Chiangmai, Lamphun and Chiangrai.

The category 'rural labourer' used here may be conveniently defined as the rural population living in a village who own no land to cultivate, but who may occasionally own a small compound or plot of agricultural land; who possess few or no implements of production, and who principally engage in wage labouring.[28] These people roughly correspond to the category called locally khon hap chang (hired man), a category which is distinct from the operating household. Persons belonging to this category include landless agricultural labourers, non-agricultural labourers, and those people who obtain supplementary income from wage labouring such as part-time agriculturists, various petty commodity producers and pedlars. In the region rural labourers of this kind who remain in villages are in many cases descendants of smallholders or landless tenants, migrants from other villages, and more

likely those who lost their holdings owing to heavy debts.

In recent years, the increasing demand for hired labour on a cash basis in operating households in substitution for the declining co-operative labour has apparently begun to provide employment opportunities for rural labourers. However, this does not necessarily mean that rural labourers began to exist only when cash payment came into widespread use (i.e. probably since the 1960's). Even before that period, there seems to have been an old-established practice of payment in paddy for hired hands, which is called khø khao (asking paddy) and which is still practised throughout the region. Although there has been a rapid growth in the number of rural labourers attributable to quite recent developments, workers of this kind have long been an essential component, together with farming households, of village society.

However, it is quite obvious that the provision of employment opportunities basically derived from partial substitution for the traditional labour exchange arrangements are not sufficient to support the growing numbers of rural labourers, smallholders and tenants. As a consequence most of these have to seek wage labouring outside villages in both the agricultural and non-agricultural sectors. In recent years there has been an increasing opportunity for wage labouring in agricultural work at large-scale fruit estates owned by capitalist developers, and in countryside factories such as those processing tobacco and fermenting the miang leaf.[29] As a result of urban development, particularly in Chiangmai, there have been some opportunities for casual employment on construction sites. However, despite these developments, there are still serious underemployment problems for the majority of peasant households, and especially for rural labourers.

CHAPTER IV

THE DELTA TYPE OF PEASANT FARMING SYSTEM

In this chapter we attempt to examine the regional characteristics of the Delta type of peasant farming system developed in the Chao Phraya delta of Thailand. As with the previous chapter, an examination will be made with regard to the natural environment, farming technology and socio-economic conditions involved in peasant rice farming on the regional scale, taking into consideration the relationships between them. Finally, we shall make an attempt to compare the two peasant farming systems at the regional level, combining the discussion of both this and the previous chapters.

1. Natural Environment

The Delta type of farming is distributed all over the Chao Phraya delta from Chainat southwards, within an area roughly corresponding to two vast-scale State Irrigation Projects, the whole area of the Greater Chao Phraya project (7,186,500 rai) and the southern part of the newly completed Greater Maeklong project (2,518,000 rai).[1] The total area under cultivation of the Delta type farming probably amounts to approximately 8.0 million rai (1,280,000 ha),[2] spreading over the whole or part of nineteen provinces in central Thailand (Figure 7). The total area planted in wet-rice is estimated at about 6.8 million rai (1,088,000 ha), which accounts for 85 per cent of the total cultivated area. In 1976, this rice planted area amounted to roughly 45 per cent of that in central Thailand and 12.7 per cent of the total in the country (53,595,000 rai) (Thailand-Ministry of Agriculture, 1977: 41). Although sugar cane and other upland crops and fruit trees are cultivated in a very limited area, it can be said that the land-use pattern of the delta is highly concentrated on wet-rice cultivation. In the surrounding areas there are considerable amounts of paddy on the relatively water-deficient terraces and fans which make up Takaya's Fan-terrace Complex. Indeed, most of the nineteen provinces in this delta in fact include some paddy area on such fans and terraces outside the deltaic part. The substantial area of the Greater Maeklong project is one of the largest such fans indenting to the delta, and its water control was much improved by the completion of the project in 1977. But these areas are not included in the delta farming region as defined in this study.

Takaya's physiographical regions of the Chao Phraya delta, as reviewed in Chapter II, are basically acceptable and have many implications relevant to irrigation and farming technology. However,

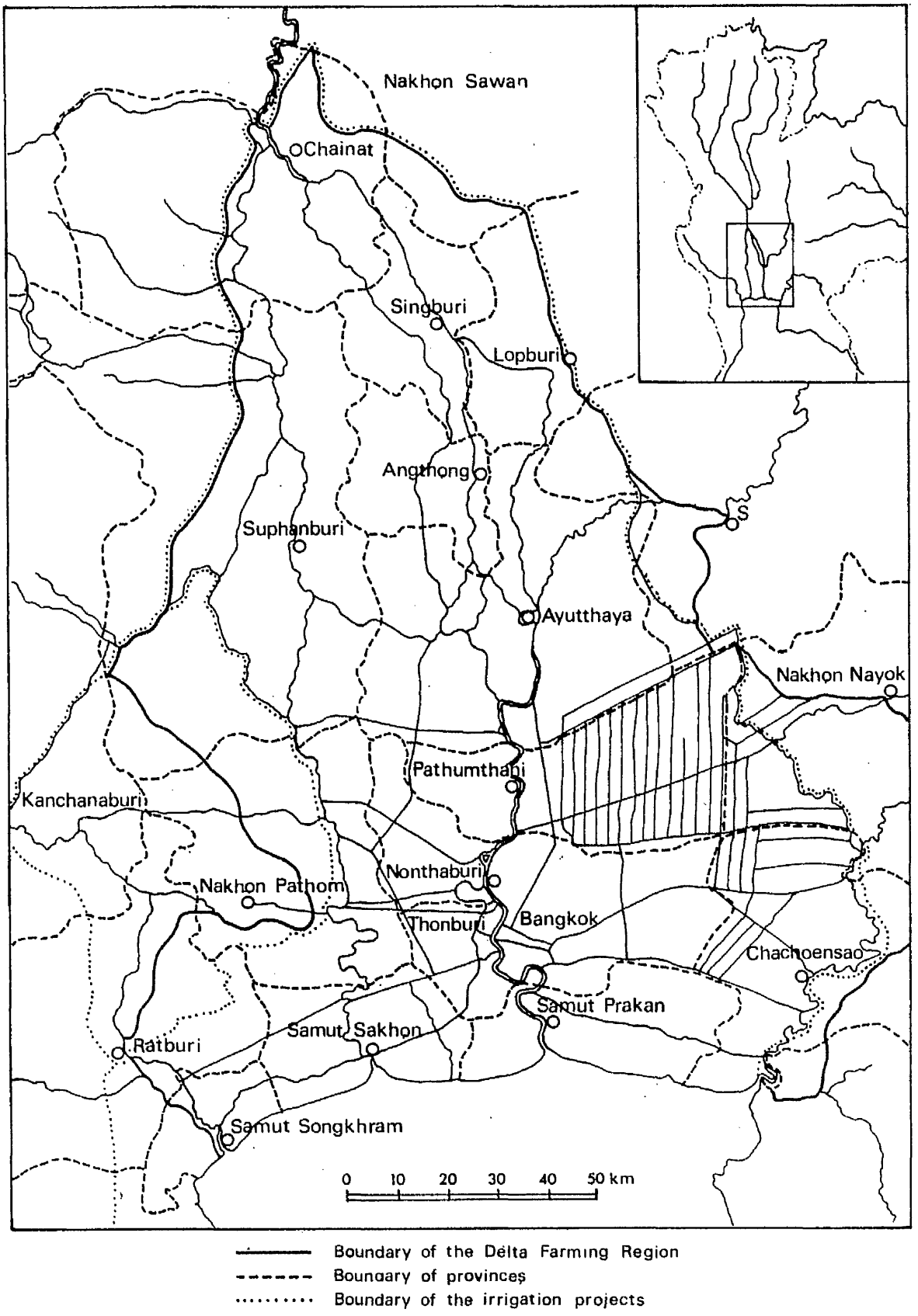
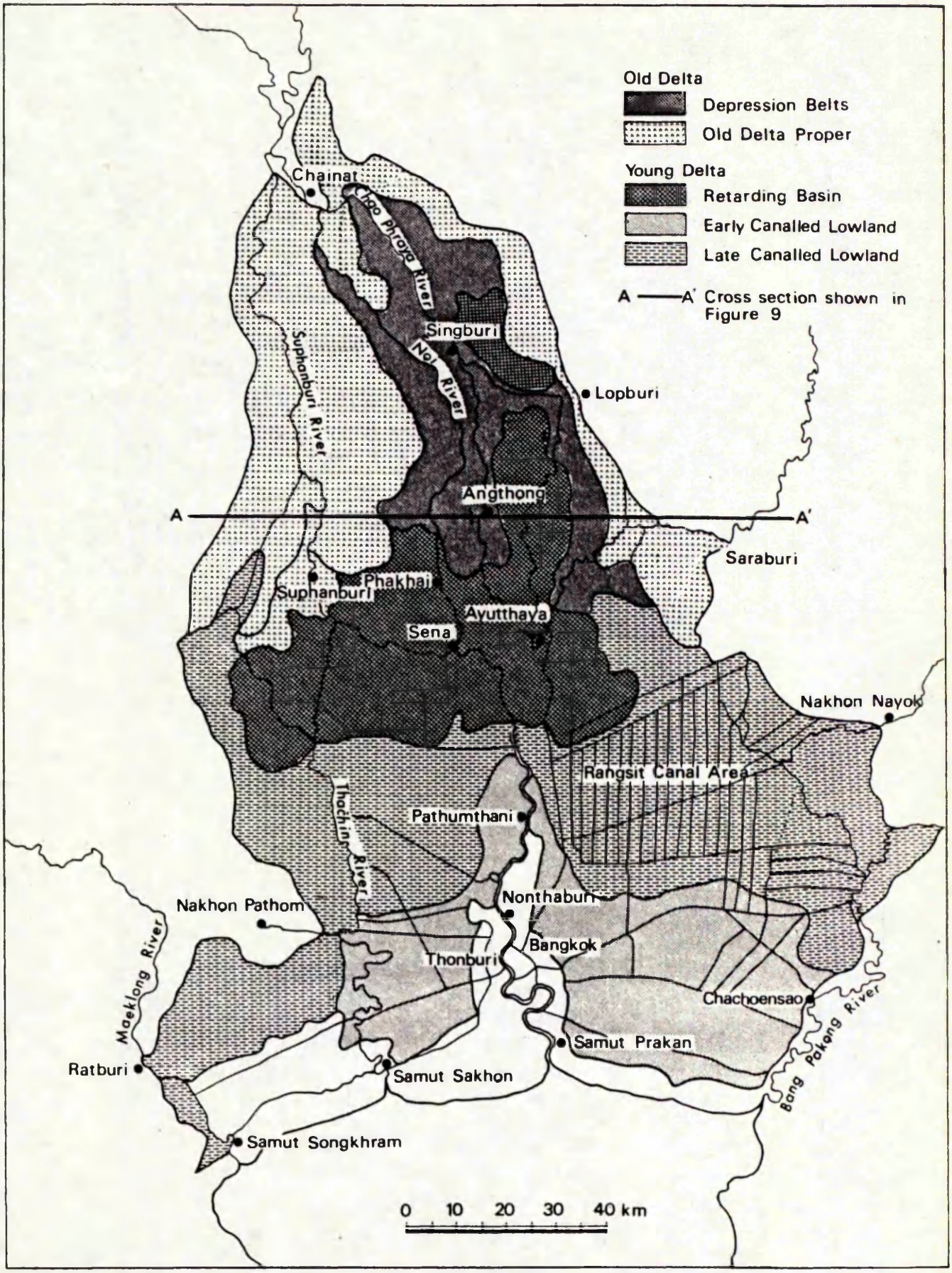


Figure 7: Region of the Delta Type of Rice Cultivation

in order to elucidate major characteristics of the Delta type of farming, further considerations especially as regards hydrography, farming techniques, and the historical process of exploitation are relevant in addition to topographical features. Taking into account these factors the region of the Delta type of farming can be analysed in terms of five subdivisions: the Depression Belts and the Old Delta Proper in the Old Delta stretching over the northern part from Chainat downwards to the east-west line through Ayutthaya, and the Retarding Basin, the Early Canalled Lowland and the Late Canalled Lowland in the Young Delta covering mainly the southern part from Ayutthaya to the coast, though in parts indenting into the Old Delta (Figure 8).

Depression Belts: This subdivision, corresponding to a part of Takaya's Old Delta, consists of chains of flood plains lying behind well-developed natural levees along the major distributaries of the Chao Phraya river. The belts are concentrated particularly along the Chao Phraya main channel, the Nǫi and Lopburi rivers, and within a smaller area around Suphanburi to the south-west. The microtopography of the belts is characterised by a complex of levees, levee slopes and backswamps, of which the latter two have traditionally been utilised for rice cultivation. The recent alluvial soils which are very fertile with silty clay or heavy clay, are almost exclusively found on the depression belts (van der Kevie, 1970: 1-12). These areas are subject to relatively prolonged and deep floods compared with the neighbouring Old Delta Proper. The latter area, in particular, exhibits a rapid rise in the water table shortly after heavy rainfall (Kaida, 1973: 407). Under such water conditions broadcast-sown rice, which usually has a taller plant height and a long maturation period, is over-whelmingly predominant in the sub-region, transplanting being confined



Source: 1974-75 survey; 1978 survey; 1979 survey; Royal Thai Army, Series of Topographical Maps (1 : 50,000, in Thai), surveyed in the 1910s and published in the 1950s.

Figure 8: Sub-Regions of the Delta Type of Rice Cultivation

to quite limited zones such as levee slopes. There is little doubt that the region was the earliest reclaimed area in the deltaic environment and remained one of the most stable rice production areas over the centuries. However, it is also true that water conditions became rather unstable due to the changes in flood regimes when the water supply in the adjacent Old Delta Proper was improved following the installation of the Chainat diversion dam in 1957 (Tomosugi, 1966: 175).

Old Delta Proper: This sub-region is mainly composed of part of Takaya's Old Delta, including a small area of alluvial fan country around its margins. With a gentle slope and slightly elevated terrain, the region covering the northern part other than the Depression Belts is relatively newly developed riceland. The semi-alluvial soils which cover the Old Delta surface are older deposits and are more weathered and less fertile than the recent sediments of the Depression Belts, but in wet-rice cultivation, these deposits are similar to the latter given an adequate water supply (van der Kevie, 1970: 1-12). By contrast with the Depression Belts, the region suffers from water deficiency, for there are no major tributaries to provide inundation, and irrigation water must perforce be drawn from a barrage upstream. It is therefore not surprising that most of the area remained uncultivated and covered by the monsoon forests until the very large scale irrigation systems were constructed in the 1960's. Once the irrigation networks were implemented and operated by the RID, the region was provided with an efficient water supply and was rapidly transformed into one of the most stable rice producing areas in Thailand. As a result of the improvement in water supply and particularly following the improvement of terminal networks, standing water in the fields can be maintained at a level

appropriate for rice farming. The excess water can be drained to the adjacent depressions, and this may have resulted in a further increase in the flood level in the Depression Belts (Kaida, 1973: 407). The widespread prevalence of transplanting culture in this region can be maintained only through the large-scale irrigation projects of the government, and to some extent, at the expense of rice-growing in the adjacent depressions.

Retarding Basin: This sub-region consists of the northern part of the recent young delta together with the Canalled Lowlands further south. The region stretches in two directions from Ayutthaya: northwards up to Singburi along the east bank of the Chao Phraya main channel, and more broadly westwards passing through the Phakhai and Sena areas up to the west bank of the Suphanburi river. In proposing a similar demarcation of the region, Takaya called the former zone a 'trough' and the latter a 'riverine delta flat', both of which he later treated together as 'the arms of the young delta' (Takaya, 1973: 267-268; Takaya, 1975: 262-263; Takaya, 1978: 174). However, even though the topographical depressions may be confined to such an area, in hydrological terms, the areas of deeply flooded depressions cover a more extensive area. From a hydrological survey, Kaida, determining the region as 'the Retarding Basin' for the delta with a capacity to store flood waters of more than 2×10^9 m^3, gave a broader demarcation, on which the present study basically relies with slight modifications (Kaida, 1973: 407).

The soils on the northern portion of the Retarding Basin are mainly composed of recent alluvial material, as in the Depression Belts. In the southern portion of the region the soils developed on brackish water alluvium are predominantly heavy clay and acid-sulphate

soils, which on the whole are suitable only for wet-rice cultivation (van der Kevie, 1970: 1-12). A striking feature of the region is its extremely deep and prolonged inundation. As a result of inflow from the upper regions, the average maximum depth exceeds 100 cm, and reaches more than 200 cm in some depressional portions. In most parts of the region inundation occurs from late July, lasts more than six months (occasionally seven months), and is drained in January or February leaving some depressional swamps. In response to such immense flooding the peasants have exclusively grown broadcast-sown late varieties including the so-called 'floating rice' or khao khün nam. Owing to lack of appropriate arrangements for water supply in the early period of cultivation and to excessive flooding in the latter part, the transplanting method of rice culture is almost totally impossible.[3] Early reclamation in the Retarding Basin, though restricted mainly to the northern part and to the areas along the main channels near Ayuttahya, possibly dates back to the fourteenth or fifteenth centuries as is the case in the Depression Belts. However, a considerable area in the southern part remained wilderness until the beginning of this century.

Early Canalled Lowland: This sub-region stretches over the southern part of the Young Delta with Bangkok as its centre northwards along the Chao Phraya as far as around Pathumthani, westwards to the Thachin (Suphanburi) river and eastwards to the Chachoensao area on the bank of the Bang Pakong river. It corresponds roughly to Takaya's topographical region of the Deltaic High, and more closely to Fukui's agronomical region of 'the Less-flooded Delta' (Takaya, 1971b: 390-391; Fukui, 1976: 160-161). On the slightly elevated terrain, a relatively dense network of natural water courses can be observed compared with other regions adjacent in the Young Delta. In addition to this quite a large

number of man-made canals or khlǫng have been excavated over a long period to provide intricate water systems which enable floods to be controlled effectively. Moreover, the marine alluvial soils covering most of the region are composed mainly of fertile non-acid materials which are well suited to wet-rice cultivation (van der Kevie, 1970: 1-12). Inundation occurs rather gently, lasts about five to six months, and in most places does not exceed 60 cm in depth (Kaida, 1973: 408). Under such favourable conditions, a considerable part of the region has been traditionally given over to the cultivation of rice by the transplanting method, and the transition from broadcast-sowing to transplanting culture is still not complete. Compared with other regions of the Young Delta, riceland reclamation most likely took place at an earlier period. The initial reclamation must have occurred since or even before the capital moved to Bangkok at the close of the eighteenth century, and further substantial expansion of riceland was achieved in association with large-scale canal excavation during the 1860's and 1870's (Tanabe, 1977: 30). As will be discussed later, the region was the most suitable frontier for the peasants to clear wilderness throughout the nineteenth century.

Late Canalled Lowland: This lowland lies in the central part of the Young Delta between the Retarding Basin and the Early Canalled Lowland, and roughly corresponds to Takaya's Delta Flat, Fukui's 'Canalled Lowland' and Kaida's 'Poldered Flat Delta' (Takaya, 1971b: 387-390; Fukui, 1976: 156-162; Kaida, 1973: 407-408). This vast lowland with very little local relief mainly consists of three parts: the Rangsit canal area to the north-east of Bangkok, the central part of the West Bank project area to the north-west and the lower part of the Greater Maeklǫng project area further west. The soils in the region are mainly heavy clay and acid-sulphate soils as in the southern

part of the Retarding Basin. Flooded water stays for quite a long period of about six months, but the maximum depth in most areas does not generally exceed 100 cm, except in the southern part of the Rangsit canal area. Although the flood conditions have been much improved through the construction of canal systems which for decades have performed various functions of drainage and poldering as well as of irrigation, the broadcast-sown method of rice cultivation is still widely practised in the region. But due to the recent successful stabilisation of water conditions, cultivation in the West Bank project area has completely changed to the early-season transplanting method. Compared with the Early Canalled Lowland, large-scale reclamation in the region started later partly because of environmental difficulties, i.e. inaccessibility into such a swampy and unhealthy wilderness. However, strong foreign demand for rice and the associated socio-economic situation since the 1880's onwards brought about an epoch-making boom in riceland reclamation, encouraging a huge number of peasants to settle the barren land (Tanabe, 1978: 58-67). A number of canals, which were essential prerequisites to securing means of access and water control, were excavated continuously in the region until the 1920's, mostly by private enterprise. Peasant reclamation was basically carried out along the lines followed by canal excavation projects.

The Delta type of rice cultivation, which is homogeneous in occurrence, can be thus classified into five subdivisions in terms of various relevant environmental factors and the process of peasant reclamation. Throughout the region various interrelated natural and technological factors seem to have formed a particular agricultural landscape within each subdivision. However, what is thought to be the most crucial natural element among peasants in the delta is simply the

water conditions, or, more precisely, the conditions of flood or nam thuam.[4] Except in such areas as the Old Delta Proper where recent irrigation improvement has achieved almost complete water control, conditions of nam thuam, even though much improved, are still the major concern among the peasants in most areas. As is the case in the intermontane basins, the delta peasants are deeply conscious of the topography from microrelief to extensive landforms, particularly in relation to the conditions of nam thuam. The landform of the lowland is generally called phünthi rap, in which the peasants always distinguish the elevated part or thi don and the depression or thi lum. The distribution of thi don and thi lum apparently reflects the hydrological implications of nam thuam rather than relief features.

Figure 9 shows an east-west cross section through the site of Angthong, which transects various farming sub-regions in the northern part of the delta. For the peasants living near Angthong and Wiset Chaichan, until about 1950 the traditional rice cultivation was almost entirely restricted to the complex area of thi lum and thi don and the area of thi lum along the three main channels, which correspond to the Depression Belt and the Retarding Basin respectively. In the areas of thi lum, broadcast-sown fields or na wan with late varieties are distributed, while transplanted fields or na dam with medium-term varieties are found in the small area of thi don scattered along the levee slopes and on the old levees. Of the late varieties, 'floating rice' has naturally been selected in the extremely deep thi lum of the Retarding Basin. On the other hand, the areas on the Old Delta Proper entirely regarded as thi don are the result of relatively recent reclamation mainly carried out since the 1950s. Natural inundation or nam thuam does not normally reach these areas of thi don, but

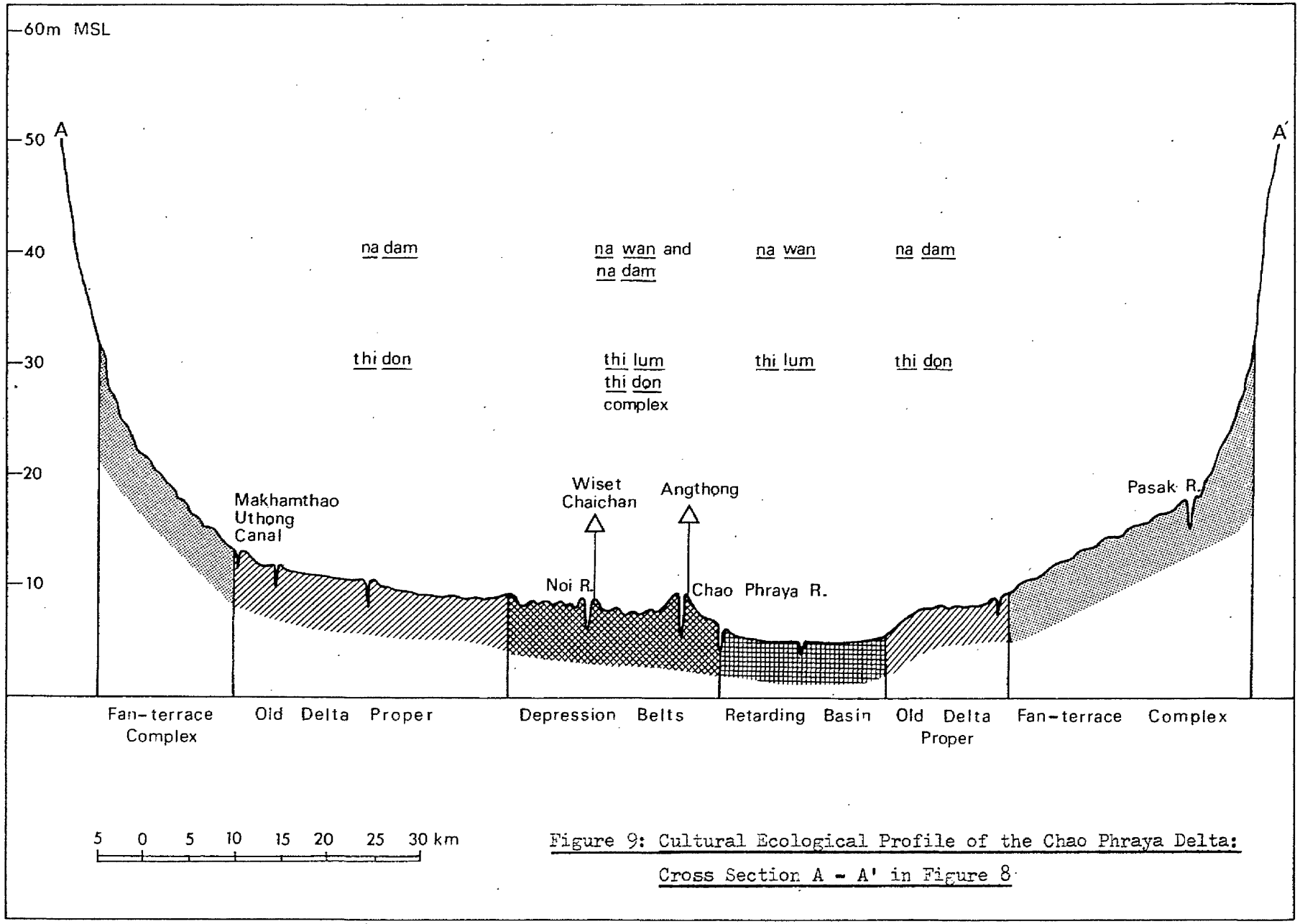


Figure 9: Cultural Ecological Profile of the Chao Phraya Delta: Cross Section A - A' in Figure 8

instead, the modern irrigation system now supplying sufficient water has converted them to transplanted areas with high productivity.

The gently-rising terrain of the Old Delta Proper merges into marginal alluvial fans on which rice fields are still expanding and on which some natural forest vegetation survives. However, throughout the delta the natural vegetation has almost disappeared owing to the continuous progress of reclamation during the past centuries, the only exception being very small areas of riverine forests. At least until the first decade of this century, as shown in a series of topographical maps compiled in the 1910's by the Royal Thai Army,[5] a substantial part of the Old Delta Proper was certainly covered by mixed deciduous monsoon forest with ubiquitous dense bamboo thickets. In those days and even in later periods, the peasants in the upper delta probably derived benefits from these areas by utilising forest resources such as timber, fuels and other raw materials for their subsistence. But by the 1950's, the monsoon forests had been completely cleared, and had given way to extensive rice fields. On the other hand, in a considerable part of the Young Delta, except for some riverine forests and coastal swamps covered by nipa palm and mangrove, extensive swamp grasslands may have developed under the repeated monsoon flooding before going under the plough. For example, it is widely known that the vast lowland of the Rangsit canal area was entirely such a swamp grassland called Thung Yai (great grass field) to which, until canal construction started in the 1880's, herds of elephants came down from the higher woodlands (Smyth, 1898: Vol.1, 53). Contrasting to the northern intermontane basins, the deltaic environment has generally been less well endowed with forest resources. Under such circumstances peasant subsistence activities other than rice-growing are greatly restricted, though fishing

flourishes throughout the delta. In such a deltaic environment which has been given over to rice monoculture, most peasants have no alternative but to obtain substantial supplies of vital commodities from outside the region. This means that within the deltaic environment, peasants find it more difficult to maintain a subsistence economy than do peasants in the intermontane basins.

2. Farming Technology

Since the completion of a huge diversion dam at Chainat and the subsequent improvement of irrigation networks in the 1960's, the entire delta region has come to be served by a magnificent water control scheme. Flooding has been artificially regulated fairly well, especially in the Young Delta, and the irrigated area has increased very substantially through distributing the waters of the Chao Phraya over the Old Delta Proper where hitherto flood water had hardly reached. In most parts of the delta the present annual flooding is no longer the natural inundation which occurred in the old days but a highly modified one, controlled to various degrees, depending on locality, by the new main canals and by more intricate tertiary canal networks and regulators. Nevertheless, except for the newly irrigated lands mostly opened up in the Old Delta Proper, the flooding or nam thuam is still the most significant element for the deltaic farming system.

Before the completion of the Greater Chao Phraya project, the inundation water, which overflowed from a number of effluents and canals linked to the main river channels, seems to have been one of the major water resources for rice-growing in most parts of the delta. However, since inundation occurred normally from July in some areas of the Depression Belts and from August or September in most parts of the Young

Delta, water supply must have depended on rainfall throughout most of the first half of the growing season. The annual large-scale flooding used to be so unreliable in its intensity and duration from year to year that inundation water was too deep and stayed too long in some years and was too shallow and stayed for too short a time in others. Such fluctuations of the flood regime seriously affected yields and frequently caused disastrous droughts and floods (Thailand-Ministry of Agriculture, 1957: 137). Despite such an irregularity in pattern, the natural flooding certainly performed a significant role in water supply, though only during the second half of the growing period, for rice-growing in most areas of the delta. By contrast to the highly artificial müang fai irrigation system which can provide relatively stable water supply to rice fields, the water environment of the delta farming was dominated by far greater uncertainty.

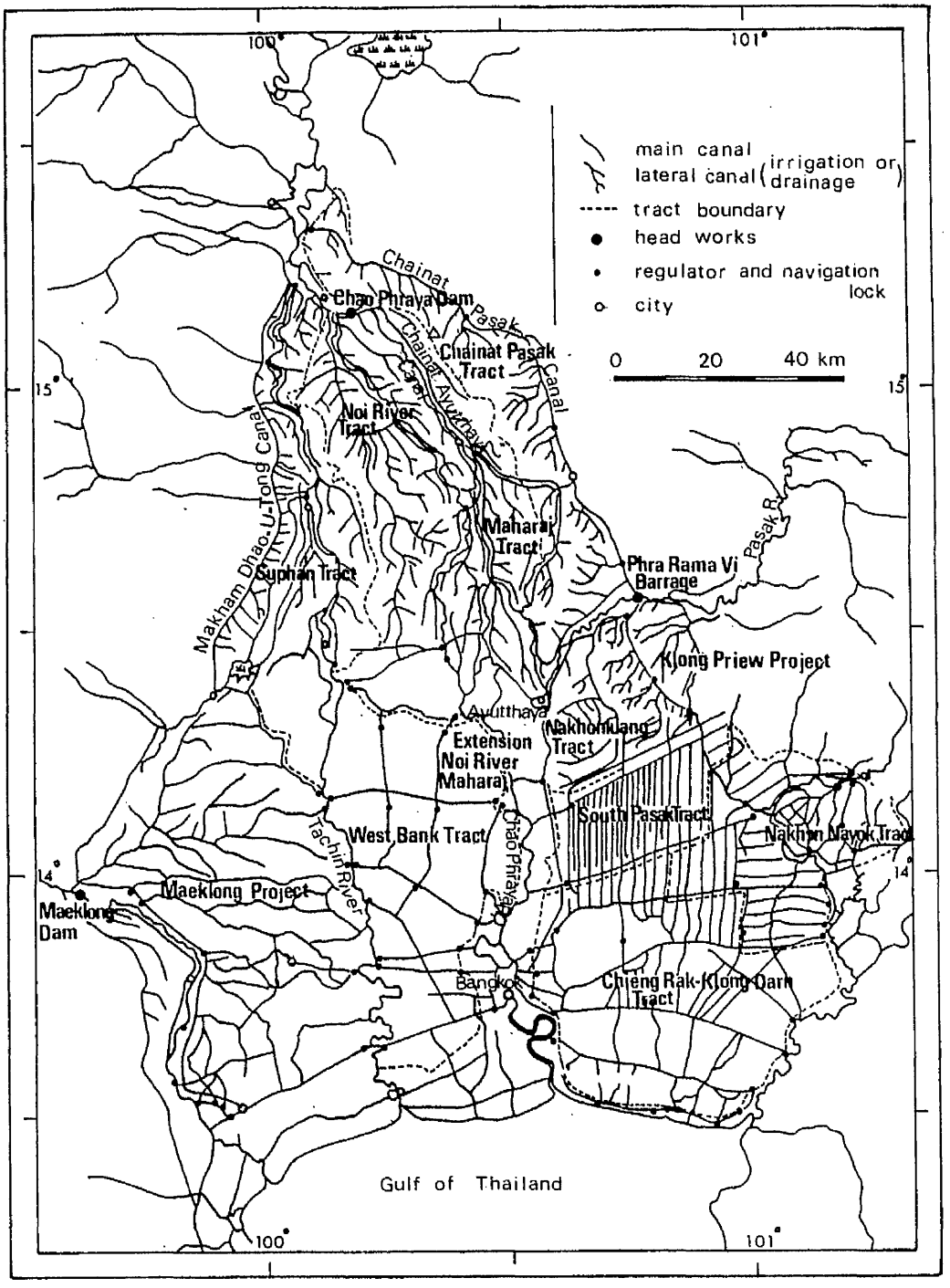
As many scholars have suggested, a dense network of numerous canals or khlǫng[6] developed, particularly in both Canalled Lowlands, from the mid nineteenth century up to the first quarter of this century. For the peasant of the delta, the khlǫng served as a communication route for the neighbourhood and as a trading route for cargo boats (rüa krachaeng) laden with paddy. At the same time they provided water for bathing, laundry and for drinking water in the dry season. The more significant function of the khlǫng, particularly since the late nineteenth century, was to provide the peasants with a means of access to wilderness to be cleared in the boom of riceland reclamation. However, if the modern concept of irrigation for rice-growing is confined to supplementary irrigation in the vegetative growth period, those traditional khlǫng by no means performed irrigation functions during that period (Graham, 1924: Vol.2, 35). Most khlǫng in the delta

opened directly to natural river channels, and with the exception of the Rangsit canal constructed at the turn of the century, they were not equipped with gates or regulators. They, therefore, could receive the water to be distributed to the fields through the tertiary khlong (excavated mainly by peasants) only when the rivers reached their highest level from August onwards (van der Heide, 1903: 27; Graham, 1924: Vol.2, 35). With such technological inefficiency, those traditional khlong clearly differ from 'irrigation canals', through which irrigation water can be supplied to fields even during the period of water deficiency by conservation of water and by regulation of its levels, and were thus termed "inundation canals" by van der Heide (van der Heide, 1900; p.25-28, 32-33).

Under such circumstances, the water environment of the Delta type of farming before the Greater Chao Phraya project, was basically characterised by total dependence on monsoon precipitation in the first half and almost uncontrolled inundation in the second half of the growing period. This being the case, the cultivation method was generally naturally restricted to broadcast-sowing rather than transplanting, which requires an intensive water supply during the first half of the growing period. However, the khlong could, to some extent, contribute to diversification of this pattern, and transplanting was practised in some areas where peasants could obtain water from the canals by lifting. In those areas a traditional water raising device, or rahat, used to be installed on the bank of the khlong in order to supplement the supply of rain water to the fields. The rahat, probably of Chinese origin, consists of a wooden trough and an endless chain of wooden dippers for lifting water through the trough, and it is supported against the bank with its lower end submerged in the khlong. It used

to be operated by men treading on pedals or using hand cranks, and was occasionally provided with a windmill to supply motive power (Thompson, 1906: 177; Pendleton, 1962: 140).[7] It could raise water usually to a height of 50 to 100 cm and to a maximum height of 150 cm. This locally manufactured device was an essential implement for transplanting along the main and tertiary canals throughout the delta for a century.[8] With respect to the usage of traditional devices and implements, it should be noted that they could only be employed in smaller areas along the khlong, and could only make good the deficiency of rain water when this was relatively slight. What is also important in this practice is the fact that it used to be essentially an individual matter which required no sort of co-operation with others. Though on some occasions they may be lent out to others, the rahat, like other farming implements, were mainly possessed by individual households and were utilised purely for irrigating their own fields. The supplementary irrigation in the delta which has been practised on a small-scale individual basis is quite different from collective forms of irrigation in the intermontane basins.

Under such water conditions and farming practices the Greater Chao Phraya project started in 1952 and has been fully operational since the early 1960's (Figure 10). The primary objective of this vast project, which determined the engineering design and irrigation capacity of the whole scheme, was originally to stabilise the harvest and to increase yields of main season rice. The emphasis was laid on the improvement of main season cultivation in the areas already under the plough, though later, particularly since the late 1960's, the increased expectations of the government have shifted to the development of the conditions necessary for off-season cropping (Small, 1973: 10; Kaida, 1978: 232-233). At the same time the project has also aimed to



Source: Personal communication with the Royal Irrigation Department, 1974; Thailand-Ministry of Agriculture, 1957: 147.

Figure 10: Outline of the Greater Chao Phraya Project

increase the irrigated area in the marginal lands of the delta by distributing the waters of the Chao Phraya over as large an area as possible (Kaida, 1978: 220).

In order to achieve the main objective, a diversion dam at Chainat and trunk canals provided with distribution systems have been constructed to supply water in the first half of the cultivation period as well as to control natural inundation in the Young Delta. In most areas of the Old Delta Proper, which are characterised by a gentle slope and by numerous small effluents, gravity irrigation systems similar to those in the intermontane basins were applied with five trunk waterways, three of which are newly excavated and two of which are canalised natural distributaries: the Suphanburi and Nφi rivers. Along the two new modern canals running through the eastern and western marginal areas much wilderness has been converted to arable land watered from these canals. On the other hand, the vast terrain of the Young Delta, being too flat to apply gravity irrigation, is irrigated by the conservation of water in a polder-like land provided with canal networks and dikes. The existing khlφng constructed in the Canalled Lowlands from the last century are fully utilised as creeks to store water and to demarcate divided tracts. Through these networks, irrigation water now reaches most areas of the Old Delta Proper in the first half of the cultivation period, while in other regions natural inundation has been controlled to a greater degree than before over an area wide enough to stabilise main season cropping as a whole. Moreover, mainly in the Old Delta Proper where gravity irrigation was introduced, a systematic improvement of terminal networks has taken place under the Ditches and Dikes Act (1962) under the direct execution of the RID, in order to facilitate more effective distribution of water to each farming plot.[9]

All these improvements of the Greater Chao Phraya project certainly seem to contribute to the stabilisation of main season rice cultivation in most areas of the delta. Former crop damage by drought and flooding has been significantly reduced in area. The shift in cultivation method from broadcast-sowing to transplanting, which is one of the changes from which the best results were expected following irrigation improvement, shows steady progress, particularly in the Old Delta Proper with the advantage of the Ditches and Dikes project. The area in transplanted rice, which covered only 22 per cent of the whole delta before 1957, increased to 35 per cent in 1964, and 55 per cent in 1970 (Kaida, 1973: 409). In the northern region of the Greater Chao Phraya project, which includes the Old Delta Proper, the Depression Belts and the upper part of the Retarding Basin, Leslie Small estimates that 16 per cent of the total planted area shifted from broadcast-sowing to transplanting by 1969 (Small, 1972: 181). The conversion to transplanting with well-controlled water supplies enables peasants to apply chemical fertilizer and herbicides, which eventually leads to increased yields. Such a logical result was expected following the water control project, and seems to have been realised to some extent, at least in some areas where the conversion has been achieved.[10] All these improvements in main season rice cultivation are believed to be attributed, to a considerable degree, to the vast-scale government irrigation project carried out during the last decades.

Nevertheless, some problems have been brought about by the progress of the water control project and the change in flooding patterns. One of the major problems is associated with the regional disparities in receiving benefit from the huge scheme. For example, as previously mentioned, the Old Delta Proper enjoys advantageous water supply by

gravity irrigation throughout the growing season, whilst the Depression Belts suffer from excess water drained off from this region. Within the Depression Belts, the same situation occurs.[11] The fields on the levee slopes receive an ample supply even in the period of water shortage and may drain the excess water to the backswamp area during the flooding season, so that the water conditions in the latter are unstable and fluctuate rather more than before the irrigation improvements. In the huge Retarding Basin the conditions of prolonged and deep inundation have by no means changed sufficiently to improve the traditional broadcast-sowing culture even after the completion of the project.[12] The huge scheme of the water control project has thus still left a considerable area where water conditions have hardly improved at all or may even have deteriorated.

A more significant and fundamental problem may lie in the social aspects of irrigation. Contrasting with most of the müang fai systems in the intermontane basins, all irrigation projects in the delta have been initiated and carried out from construction to operation and maintenance exclusively by the government. Even in the construction of terminal networks, the government has undertaken the overall responsibility for the projects, even though the Ditches and Dikes Act prescribes that the peasant users shall carry out the construction individually at their own expense. It can be said that the government has been entirely responsible for irrigation in the delta and the peasants' contribution and participation has been almost minimal. The peasants in the Delta type of farming have thus developed little social organisation to control water conditions, and even after the Greater Chao Phraya project they remain unlikely to do so. This is partly because the traditional farming system characteristic of the delta

has been strongly dependent on the natural flooding and the peasants have been able to respond only passively to its nature.[13] Also the recent irrigation projects brought about improvements in conditions, but they were not extensive enough to drastically change such a traditional farming system and the peasants' view towards nature. Even though crop damage has been reduced markedly and the average yield of the total area has considerably increased, the traditional farming pattern has remained basically unchanged in many parts of the delta, except in some areas where gravity irrigation has been effectively adopted in the Old Delta Proper, and the southern part of the Early Canalled Lowland where early season cultivation was recently introduced. In most regions the broadcast-sowing continues to rely on rainfall, and traditional transplanting cultivation can mostly be carried on by individuals using water-raising devices or, in many cases, the more effective but expensive power pump. Tiding over the water-shortage period in such ways, both the traditional methods of cultivation are still basically dictated by the conditions of nam thuam throughout the second half of the cultivation period. Although the RID operates and maintains the entire scheme of water control by dividing it into some forty tracts, the water conditions in relatively smaller areas are actually beyond the control of peasant communities or individuals. In contrast to the intermontane basins, the water resources still remain unmanageable and uncertain when it comes to actual farming in most areas of the delta.

The farming technology of the delta region reflects different water conditions and is thus characterised by a complex distribution of the broadcast-sowing and transplanting methods. The technical differences between the two basically lie in the series of farming operations during the first half of the growing period. The broadcast-sowing culture

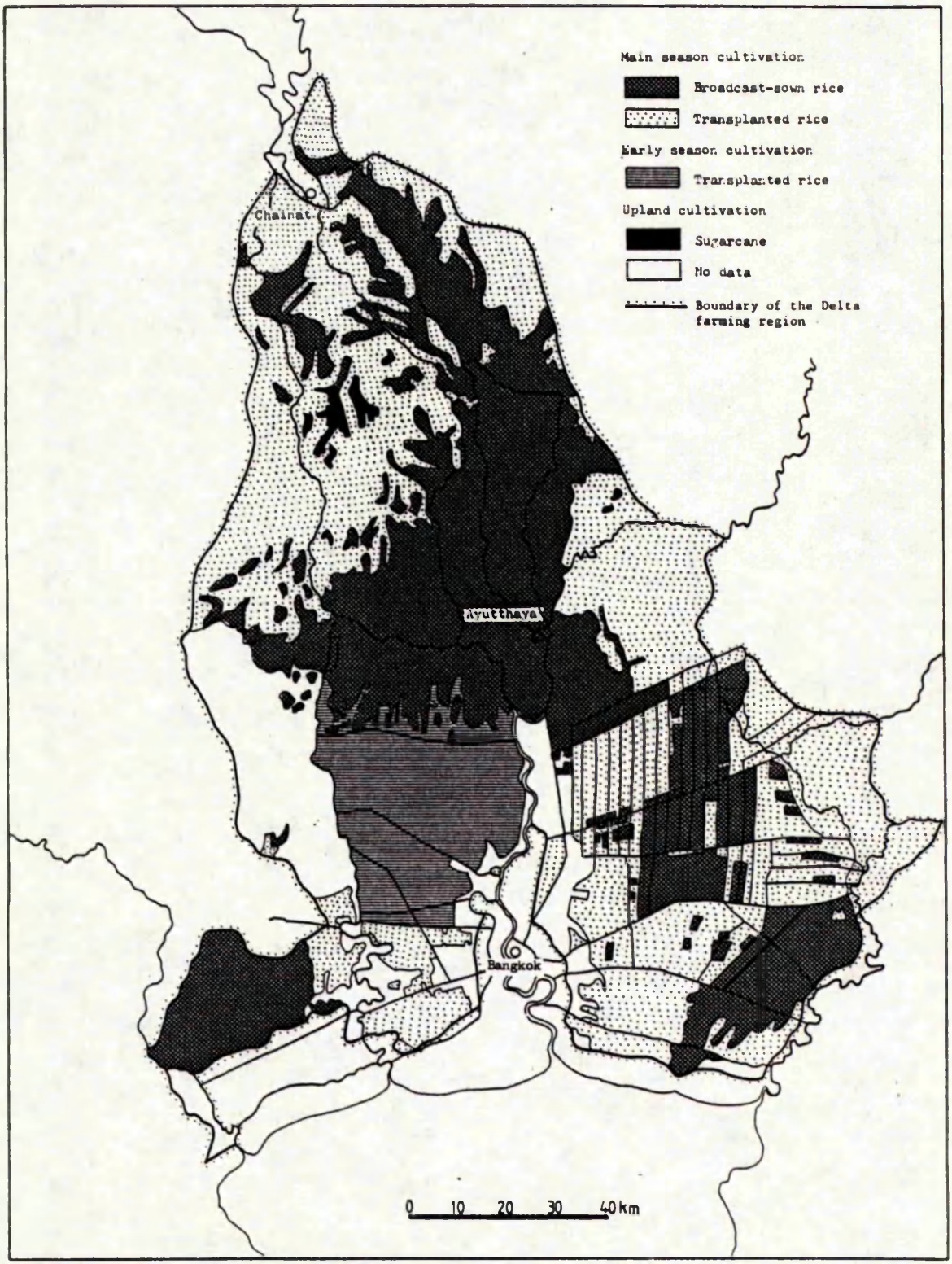
in the delta is generally characterised by two farming stages which present a rational and efficient adaptation to the uncertain water condtions. The first is land preparation, which traditionally took place after the beginning of the monsoon rains, giving sufficient moisture to allow buffalo ploughing. The start of farming was dependent almost entirely upon the uncertain pattern of monsoon precipitation, though this problem has become overcome technically by the introduction of tractor and power tiller ploughing in recent years. At the second stage, this method is characterised by direct seed-sowing on the main plot without the transplanting of seedlings at a later period. This operation also requires timing to adjust to monsoon rainfall. After these operations are completed, the plot remains almost untouched and is subject to inundation up to the harvesting time. In contrast to the broadcast-sowing cultivation, the transplanting cultivation practised in the delta is basically similar to that in the intermontane basins, though there are many technical differences in detail.

Throughout the farming operations, broadcast-sowing culture is relatively less labour-intensive than transplanting culture practised elsewhere, whether in the intermontane basins or in the delta. This is mainly derived from the fact that the broadcast-sowing culture does not involve labour-intensive and sophisticated operations such as nursery culture and uprooting-transplanting, which are an essential concomitant to the transplanting culture. Thus in the broadcast-sowing culture the peak period of intensive labour demand occurs normally only in harvesting, while there are two peak periods at uprooting-transplanting and at harvesting for the transplanting culture. Throughout the delta region the traditional co-operative labour arrangement, which used to provide a necessary supplement to the

domestic labour of households in these operations, has markedly declined over recent decades. Instead, wage labour has now become the most reliable and inevitable labour resource in most localities of the Delta farming region.

The spatial distribution of the two cultivation methods can be shown in Figure 11 for the 1977 cropping season. The broadcast-sown field, or na wan, was once apparently predominant throughout the delta, though it has gradually been reduced in area with the advance of irrigation improvement to about 45 per cent of the total planted area in 1970 and probably to about 40 per cent in 1977. As shown in the figure, broadcast sown rice characterises the backswamps in the Depression Belts and the Retarding Basin, where the prolonged deep flooding occurs. In the Late Canalled Lowland where it was once predominant, the area in na wan is decreasing particularly due to the recent development of the early season rice cultivation by transplanting in the West Bank project area. The transplanted field, or na dam type of cultivation, on the other hand, was traditionally practised by collecting surface drainage water in addition to rainfall supplies on the levee slopes in the Depression Belts and by water-lifting from the khlong in the Early Canalled Lowland and in some areas in the Late Canalled Lowland. As previously mentioned, the area of na dam was expanded into the Old Delta Proper, and increased in both Canalled Lowlands during the past decade after the completion of the Greater Chao Phraya project.

This distribution pattern of the two cultivation methods is a result of peasant adaptation and is almost completely determined by the present water conditions and the degree of irrigation improvement. Both methods of cultivation have been perpetuated, depending on the changing water conditions, throughout the history of the region, and



Source: Personal communication with the Royal Irrigation Department, 1978

Figure 11: Area of Broadcast-sown and Transplanted Rice in the Chao Phraya Delta, 1977-78

are thus conspicuous elements in the Deltaic farming system today. By creating an increasingly artificial irrigation environment, the government is intending to facilitate the shift from na wan to na dam. However, broadcast-sowing which is more strongly dependent on the deltaic environment will remain one of the most efficient methods, since perfect control of inundation in certain small areas is hardly possible.

In contrast to the intermontane basins, the paddy lands of this region are overwhelmingly devoted to non-glutinous rice cultivation both for consumption and for disposal in the market, and glutinous rice cultivation is minimal. From an agronomic point of view, non-glutinous rice and its cultivation are believed to have appeared in this delta sometime after the eleventh century, and the predominance of non-glutinous rice cultivation[14] was rapidly accelerated with the advance of export-rice production in the latter half of the nineteenth century (Watabe, 1976: 112). At present, most peasants in the region are non-glutinous rice eaters, though they consume a small amount of glutinous rice to make sweetmeats. In most provinces in the delta the area planted to non-glutinous rice amounts to more than 98 per cent of the total planted area under rice cultivation, apart from in Lopburi (97.9 per cent) and Saraburi (96.6 per cent), in 1965[15] (Thailand, 1968: 70-71). Contrary to the subsistence outlook which characterised the intermontane basins, a considerable part of the non-glutinous production in this region is marketed for export. Most peasant cultivators in the delta have long been more deeply involved in the rice market economy than in any other region since the late nineteenth century, and the region still remains a major export-rice producing area (van der Heide, 1906: 90-91; Ingram, 1971).

As previously mentioned, the average yield in the delta has increased and is now comparable with that in the intermontane basins since the completion of the Greater Chao Phraya project. However, the yields vary considerably from place to place as shown in Table 11. Although the figures are given by province and do not precisely represent the area within the Delta farming region, the general tendency of regional variation in yield is apparent. The higher yield of 33 to 46 thang per rai (2.1 - 2.9 tonne/ha) is mainly attained in the Depression Belts and in the Old Delta Proper, particularly in the four provinces namely Chainat, Singburi, Angthong and Suphanburi. The lower average yield of 27 to 33 thang per rai (1.7 - 2.1 tonne/ha) is represented by the Retarding Basin, the Late Canalled Lowland and the Early Canalled Lowland. Such variation in the average yield does not necessarily reflect precisely differences in cultivation methods. In certain areas, such as backswamps in the Depression Belts, yields from the traditional broadcast-sowing method have been relatively stable and even higher than those from the transplanting cultivation on the adjacent levee slopes. Moreover, the yield of the transplanting cultivation in the Rangsit canal area in the Late Canalled Lowland is normally lower than 30 thang per rai (1.9 tonne/ha), comparable with that of broadcast-sowing cultivation in the Retarding Basin near Ayutthaya (Fukui, 1978: 252). These differences in yield seem to reflect to a considerable degree differences in natural soil fertility as much as differences in the cultivation methods employed: the recent alluvial soils of the Depression Belts are more fertile than the acid-sulphate soils found in the Retarding Basin and the Late Canalled Lowland. The yearly fluctuation of yield is low in the Old Delta Proper, apparently due to the well-controlled gravity irrigation system, but in the rest of the area it remains large. This is probably

TABLE 11: Average Yield in the Delta Farming Region

Sub-region	Province	Average yield, 1973-1979 thang/rai	tonne/ha
Depression Belts and Old Delta Proper			
	Chainat	35.3	2.2
	Singburi	45.5	2.9
	Angthong	38.8	2.5
	Suphanburi	32.9	2.1
	Lopburi	31.2	2.0
	Saraburi	34.5	2.2
Retarding Basin			
	Ayutthaya	29.3	1.9
Late Canalled Lowland			
	Pathumthani	31.0	2.0
	Nonthaburi	29.3	1.9
	Nakhon Pathom	33.3	2.1
	Samut Songkhram	21.5	1.4
	Nakhon Nayok	29.5	1.9
	Chachoengsao	31.3	2.0
Early Canalled Lowland			
	Bangkok	32.7	2.1
	Thonburi	-	-
	Samut Prakan	29.8	1.9
	Samut Sakhon	27.0	1.7
Total		32.7	2.1
Total in the Intermontane Basin		45.2	2.8
Total in the whole country		25.7	1.6

Source: Thailand-Ministry of Agriculture, 1978: 16-19.

due to the uncertainty of rainfall and inundation still prevailing in the Delta farming region.

3. Socio-economic Conditions

(1) Peasant Farming as Petty Commodity Production

Table 12 shows some basic farming data for seventeen provinces in which the entire province or more than 50 per cent of the total paddy area lies within the delta farming region. The figures from these seventeen provinces, therefore, do not indicate precisely the data for the delta region, for they might include statistics from areas outside the delta. It is convenient, however, to consider here that these figures roughly represent the general trends of the Delta type of farming. With the average of 22.2 rai (3.6 ha), the farm size in the region is large, indeed about 3.5 times the average in the intermontane basins. The extensive cultivation of more than 29 rai (4.6 ha) in Pathumthani, Nakhon Nayok and Chachoengsao provinces is associated with the development of tenancy under the accumulation of large holdings by absentee landlords since the beginning of this century.[16]

Reduction of farm size caused by the subdivision of holdings over generations seems to have occurred in the same way as in the intermontane basins. According to Prince Dilock, at the turn of the century many households operated as much as 80 to 100 rai, in some cases as much as 200 rai under the favourable water conditions in depressions (Dilock, 1908: 98). According to the data of the seven villages surveyed by Zimmerman in the early 1930's the average farm size was 38.8 rai (Zimmerman, 1931: 25-28). The post-war community studies in the vicinity of Bangkok give 33.9 rai in Bang Chan in 1948, 30.7 rai in

TABLE 12: Estimated Average Area Operated and Gross Product per Household in the Delta Farming Region

Province	No. of rice farming households 1968	Estimated No. of rice farming households 1977*	Average size of farm household 1970 (persons)	Average operated area/ household 1973-77 (rai)	Average gross product/ household 1973-77 (thang)
Depression Belts and Old Delta Proper					
Chainat	27,587	35,504	5.3	20.7	730
Singburi	15,374	19,786	5.5	19.6	893
Angthong	20,647	26,537	5.6	17.5	681
Suphanburi	52,497	67,564	5.7	21.1	691
Lopburi	31,069	39,986	5.4	21.1	658
Saraburi	22,655	29,160	5.5	26.5	910
Retarding Basin					
Ayutthaya	36,690	47,220	5.6	22.0	648
Late Canalled Lowland					
Pathumthani	17,097	22,004	6.2	34.5	1,070
Nonthaburi	9,482	12,203	5.9	16.2	475
Nakhon Pathom	28,331	36,462	6.1	15.2	507
Samut Songkhram	966	1,243	5.8	24.8	533
Nakhon Nayok	16,405	21,113	5.9	33.6	992
Chachoengsao	27,703	35,654	5.9	29.2	915
Early Canalled Lowland					
Bangkok	12,853	16,542	6.2	16.5	540
Thonburi	4,568	5,879	6.5		
Samut Prakan	9,686	12,466	6.5	16.4	488
Samut Sakhon	6,831	8,791	6.2	20.2	546
Total	340,441	438,150	5.9	22.2	724
Total in the Intermontane Basin	402,146	517,563		6.3	284
Total in the whole country	2,766,932	3,561,041		14.4	369

* The number of rice farming households in 1977 is estimated as shown in Table 7.

Source: Thailand-National Statistical Office, 1969: 49-50; Thailand-National Statistical Office, 1970b; Thailand-Ministry of Agriculture, 1978: 14-21.

1953, and 26.5 rai in Bang Khuat in the 1950's (Sharp et al., 1953: 140; Kamol, 1955: 57, 52; Kaufman, 1960: 241).

Although the average yield is lower than that in the intermontane basins, larger farm size, in general, results in a considerable gross production, which amounts to 724 thang (7.3 tonnes) on average. In the same way as in the case of the intermontane basins, taking the per capita milled rice consumption of 166.7 kg (Thailand-National Statistical Office, 1964: 7, Table 1; Dixon, 1974: 2), and the average size of farming household of 5.9 person/household, the necessary paddy equivalent for yearly consumption per household will amount to about 163 thang (Table 8). This suggests that peasant households with an average farm size can produce a moderate surplus, enough for some rice to be disposed in the market in addition to that required for subsistence consumption. However, it should be noted that despite the relatively low input of domestic labour, the increasing use of hired labour, together with the employment of power devices and other kinds of industrial input, raise production costs considerably.[17] When production costs, including land rent which varies from 30 to 40 per cent of the gross product, is deducted from the gross production, a tenant cultivating an average farm size of 22.2 rai seems to be able to afford only a slender livelihood. Whatever the case, it is reasonable to assume that the rice farming of the delta, where technology is less labour-intensive and farm size greater than in the intermontane basins, has a general tendency towards commodity production.

It is more difficult to estimate a viable farm size for maintaining the minimum subsistence level of living for delta peasants than in the case of the intermontane basins. Since the greater proportion of produce is

disposed of in the market, the yearly fluctuation of the farm gate paddy price has a crucial effect upon the cash income of peasant producers. For example, in 1971 and 1972, when the farm gate paddy price in Ayutthaya fell to about 9 baht per thang, even peasants owning 50 rai suffered heavy deficits, while in 1975 thanks to the high price of about 25 baht per thang, a peasant with 20 rai could more or less manage on his gross cash income which amounted to about 10,000 baht. In estimating the minimum viable size, we must also take into account the extremely high cash expenditure for consumption which could be as much as twice that in the intermontane basins.[18] In 1976 one source suggested 25 rai as the proper minimum size for the delta region, a little higher than the average operating farm size of 22.2 between 1973-77 (Investor, 1976: February).

Table 13 portrays the circumstances with respect to peasants in a village in Ayutthaya province in 1975. According to a survey undertaken in this village by the author, the socially expected size for minimum subsistence varies from 20 to 25 rai. As in the case of Chiangmai every peasant in Ayutthaya knows the size of land and harvest which could support his family at the minimum subsistence level. For every village peasant, as with Chiangmai, the size of harvest, assuming possible fluctuations in average yield, and the size of home consumption are of great importance in his reckoning of the production economy.

As in the case of Chiangmai, the necessary paddy for home consumption is called khao kepwai kin (literally, paddy for home consumption), and is customarily said to amount to about 40 thang (800 litres or 400 kg) per person per annum in Ayutthaya, which is slightly lower than that required in Chiangmai. However, the peasant concept of khao kepwai kin, which represents the use values produced,

TABLE 13: Rice Production Economy in Ayutthaya Village on the Basis of Socially Expected Farm Size, 1975

Expected farm size	20 rai			25 rai		
Yield: thang per rai	25	30	35	25	30	35
Total gross product	500.0	600.0	700.0	625.0	750.0	875.0
Khao kepwai kin* (Paddy for home consumption)	172.0	172.0	172.0	172.0	172.0	172.0
Food**	152.0	152.0	152.0	152.0	152.0	152.0
Reserve	20.0	20.0	20.0	20.0	20.0	20.0
Production cost in kind	40.0	40.0	40.0	50.0	50.0	50.0
Seed	40.0	40.0	40.0	50.0	50.0	50.0
Total non-sale disposal	212.0	212.0	212.0	222.0	222.0	222.0
Possible amount for sale and other purposes	288.0	388.0	488.0	403.0	528.0	653.0
Percentage of gross production	57.6%	64.7%	69.7%	64.5%	70.4%	74.6%

* The calculation is based on the assumption that a household consists of five persons.

** The paddy consumption per capita per year in the surveyed village is 307.2 kg (c. 30.4 thang), the milled rice consumption being 1.0 litres per capita per day. These figures are a bit higher than those in the 1963 Household Expenditure Survey, and are lower than those in Chiangmai Village. See Tables 8 and 9.

Source: 1974-75 Survey.

is different in its composition from that expressed in Chiangmai. While Chiangmai's concept includes, in addition to paddy for food, various particular purposes such as contribution to the wat, barter and a specific reserve, the calculations for Ayutthaya include only the necessary paddy for food and a reserve. Contributions to the wat are usually made in cash, though a small amount of boiled rice and other food are put in the bowls of Buddhist priests every morning, and barter has completely been replaced by monetised exchange in the daily life of Ayutthaya. Therefore Ayutthaya's concept of khao kepwai kin has excluded these items which still constitute important parts of subsistence production in Chiangmai village. The portion retained as a reserve within Aytthaya's khao kepwai kin is said to be approximately 20 thang of paddy per household, which is lower than the 25 thang in Chiangmai village. This portion is utilised for ceremonial purposes, entertainment, gifts to kinsmen and so on. However, what is said to be the reserve appears to be sold actually in many cases.

Given a socially expected farm size (20 to 25 rai), most peasants assign a greater proportion of the gross product to market disposal, which accounts for about 58 to 75 per cent of the total after removing the necessary amount for home consumption and seed. But in actual cases the proportion for market disposal seems to be higher than these figures, due to the need for cash income to meet increasing production costs and household domestic expenditure, including debt repayment. It is commonly observed in Ayutthaya village that when yields per rai fall, many peasants are compelled to sell more paddy, often at the expense of what is available for their khao kepwai kin. There are many cases of tenants and even some owner-operators cultivating 20 to 25 rai, who have to sell most of their production, leaving nothing or

a minimal 50 - 100 thang of paddy to sustain consumption for a few months, after which they have to buy milled rice at the market.

We should note here that even though Ayutthaya's peasants dispose of a much greater proportion of their products in the market, they do so not only for entrepreneurial profit but also for the domestic requirements of the household in the same way as seen in the intermontane basins. Such a characteristic of peasant petty commodity production which Galeski calls 'the identification of the enterprise with the domestic economy of the family household' can be widely observed throughout the delta (Galeski, 1972: 10-11).[19]

(2) Development of Tenancy

It has been shown by many scholars that tenancy is widespread within the Chao Phraya delta (Sternstein, 1967: 23-26; Tomosugi, 1969: 294-333; Niphon, 1974: 308-445; Turton, 1978: 109-113).[20] Although figures are given by provinces, and do not necessarily reflect precisely the situation in the Delta farming region, Table 14 indicates, to some extent, the pattern and magnitude of tenancy in recent years. The area of land rented in the seventeen provinces accounts for 38.35 per cent of the total area of land under tenure, about 16.3 million rai, of which about 8.0 million rai may be in the delta farming region. Obviously, this figure indicates not the ratio of land rented in the delta proper but the ratio for the whole area including marginal fans and terraces in which the area of land rented would apparently be smaller. In order to obtain a more realistic picture of tenancy in the delta we need data relevant to the region, which are given by lower administrative units. The only reliable source of such data appears to be the 1967/8 land tenure survey conducted by the Ministry of National Development in

TABLE 14: Area under Tenancy and Number of Tenants and Part Tenants in the Chao Phraya Delta

Province	Area under tenure, 1973 rai	Area under tenancy 1973 rai	(% 1973)	No. of farm households* 1976	No. of tenants and part tenants* 1976	(% 1973/4)
Depression Belts and Old Delta Proper						
Chainat	1,197,243	222,031	(18.55)	38,950	12,655	(32.49)
Sinburi	478.272	137,376	(28.72)	22,071	8,122	(36.80)
Angthong	555,247	190,060	(34.23)	29,585	14,764	(49.92)
Suphanburi	2,557,296	734,455	(28.73)	79,943	27,253	(34.09)
Lopburi	2,409,287	622,152	(25.82)	61,555	27,700	(45.00)
Saraburi	1,473,945	503,358	(34.15)	38,843	20,820	(53.60)
Retarding Basin						
Ayutthaya	1,431,479	840,518	(58.72)	46,447	35,527	(76.49)
Late Canalled Lowland						
Pathumthani	841,112	619,311	(73.63)	22,837	19,165	(83.92)
Nonthaburi	257,409	141,042	(54.79)	20,353	10,091	(49.58)
Nakhon Pathom	1,183,477	424,158	(35.84)	47,086	18,095	(38.43)
Samut Songkhram	171,770	35,072	(20.42)	10,248	2,939	(28.68)
Nakhon Nayok	898,101	505,990	(56.34)	20,360	13,784	(67.70)
Chachoengsao	1,630,488	763,362	(46.82)	39,063	24,860	(63.64)
Early Canalled Lowland						
Bangkok-Thonburi	496,582	205,237	(41.33)	-	-	
Thonburi				21,663	6,685	(30.86)
Samut Prakan	364,305	228,607	(62.76)	13,069	9,350	(71.54)
Samut Sakhon	341,772	73,860	(21.61)	13,237	13,237	(42.10)
Total	16,287,781	6,246,589	(38.35)	525,310	257,383	(49.00)
Total of the Intermontane Basins	5,508,613	899,695	(16.35)	560,393	137,536	(24.54)
Total of the whole country	112,753,578	13,834,225	(12.27)	4,379,543	912,858	(20.84)

* Figures estimated from the 1970 Population Census by the Agricultural Land Reform Office.
Source: Thailand-Ministry of Agriculture, 1975: 5-9; Thailand-Agricultural Land Reform Office, 1977: 6-10.

twenty-six provinces of the central region. This presents land tenure data by districts. In dealing with the data given in the 1967/8 survey, Tomosugi divides all districts into two regions: 95 districts in the Chao Phraya delta region and 73 districts in the outer region, and rearranges the data by regions (Tomosugi, 1970: 13-14) as shown in Table 15. The area covered by the 95 districts including the marginal areas is still more extensive than the Delta type of farming region with which this study is concerned, but it may be considered as a fairly accurate indication of the realities of the tenancy situation of the delta. The data show that about 60 per cent of all households are tenants or part tenants, and indeed rented land amounts to nearly 50 per cent of the total area. Such a high ratio of tenancy is in marked contrast to the outer regions of central Thailand, and to the intermontane basins as a whole. It should be said that the Delta type of farming region is unique in terms of the prevalence of tenancy.

With respect to the regional pattern of tenancy, there seems to be a certain tendency related to the historical process of reclamation which we have briefly discussed in terms of the sub-division of the Delta type of farming system. As shown in Table 14, high ratios both in households renting land and in the area under tenancy characterise the Retarding Basin: for example, Ayutthaya; the Late Canalled Lowland: Pathumthani, Nonthaburi, Nakhon Nayok and Chachoengsao; and the Early Canalled Lowland: Samut Prakan. A considerable proportion of the riceland in these provinces was recovered from wilderness after the end of the nineteenth century as a result of large-scale reclamation accompanied by privately financed canal projects (Tanabe, 1978 : 58-67). This implies that in those provinces large-scale reclamation is most likely to have been responsible for the formation of tenancy under great absentee landlords. On the

TABLE 15: Area under Tenancy and Number of Tenants and Part Tenants as recorded in the 1967/8 Land Tenure Survey

Land tenure status	No. of households	(%)	Area planted, 1967/8 Area owned (rai)	Area rented (rai)	Total (rai)
95 districts in the Chao Phraya Delta Region					
Owner-operator	110,975	(41.78)	3,134,872	-	3,134,872
Part tenant	64,139	(24.14)	1,379,543	1,433,182	2,812,725
Tenant	90,522	(34.08)	-	2,811,388	2,811,388
Total	265,636	(100)	4,514,415	4,244,570	8,758,985
Percentage			51.54%	48.46%	100.00%
73 districts in the Outer Region					
Owner-operator	233,589	(85.12)	5,775,599	-	5,775,599
Part tenant	18,382	(6.70)	344,061	326,378	670,439
Tenant	32,446	(8.18)	-	684,221	684,221
Total	274,417	(100)	6,119,660	1,010,599	7,130,259
Percentage			85.83%	14.17%	100.00%
Sum total	540,053		10,634,075	5,255,169	15,889,244
Percentage			66.93%	33.07%	100.00%

Source: Thailand-Ministry of National Development, 1968; Tomosugi, 1970: 13-14.

other hand, the ratios are relatively low in the Old Delta Proper and Depression Belts: Chainat, Singburi, Suphanburi and a part of Angthong, where small-scale peasant reclamation has predominantly proceeded throughout history, being less affected by the boom in riceland reclamation around the turn of the century. At the same time, the development of the Great Chao Phraya project provided opportunities for peasant reclamation in the newly opened frontier of the Old Delta Proper during the 1960's, and seems to have contributed to some degree to restraining the rise in the ratio of rented land in these provinces. In both Lopburi and Saraburi provinces, the western parts included in the delta constitute an old rice-growing area, while the land utilisation of the eastern parts stretching into the hilly terrain have been largely characterised in recent years by upland cultivation, particularly the cultivation of maize for export since the late 1950's.[21] Reflecting such differences in land utilisation and associated reclamation processes, the western parts of both provinces show a relatively high ratio of rented land, while most peasants in the eastern parts have recently gained their own land for upland cultivation (Thailand-Ministry of National Development, 1968: Table 15-18). Thus it seems to be quite common that the degree of tenancy varies considerably within smaller areas. However, it is nevertheless possible to argue that tenancy is more widely prevalent in the Delta type of farming region as a whole than in any other region, and there has been a particularly striking development of tenancy under great absentee landlords especially in the Retarding Basin, the Late Canalled Lowland and in part of the Early Canalled Lowland.

Within such a general pattern, we can recognise the widespread prevalence of two types of tenancy: that under petty local landlords and that under absentee landlords, as in the case of the intermontane

basins. We have seen the predominance of renting by petty local landlords in the intermontane basins as a whole. In the Delta farming region, conversely, the renting by absentee landlords who are middlemen, rice-mill operators, traders, and officials living in provincial or district towns and sometimes in Bangkok, is more commonly observed. These absentee landlords, many of whom own over 200 rai have accumulated their large holdings over many decades through inheritance, purchasing and foreclosing the mortgages of indebted smallholders.[22] Acting simultaneously as urban capitalist entrepreneurs, these absentee landlords often perform the role of moneylender or nai thun to peasants in the countryside. Their investment in land, often being of a purely speculative nature, seems to have steadily taken place in areas adjacent to Bangkok, especially since the 1950's (Kamol, 1955: 71; Investor, 1975: August; Turton, 1978: 111). As a rule most of these absentee landlords have few relationships with the village communities in which their holdings exist, aside from the collection of land rent and moneylending to the peasants. Unlike petty local landlords who still remain within the villages, their relationships to tenants are established completely outside the village communities. Where a landlord is very powerful his agent or nai kong[23], who may be a town resident or a village dweller, often takes over the management of his holdings, keeping in contact with the tenants.

Among a great number of absentee landlords there are a handful who own several hundred rai and occasionally over 1,000 rai, and most of whose landed properties have derived from speculative accumulation of land over many decades, especially from the large-scale reclamation since the turn of the century. Tenancy under such great landlords has developed extensively in a few provinces, as mentioned

above. One of the most well-known areas where this form of landlordism has developed to a serious extent is the Rangsit canal area which was excavated by the Siam Canals, Land and Irrigation Company in Pathumthani and adjacent provinces north-east of Bangkok around the turn of the century.[24] Under the general tendency towards the establishment of private landownership during that period, the government contract awarded in 1888 recognised that all unowned land within 40 sen (1,600 m) on either side of the new canals would become the possession of the company from the time of construction (P.K.P.S.: Vol.11, 237-244). In this way, the company was able to sell huge areas of land to members of the royal family, noble officials, and peasants. The large-scale reclamation in the Rangsit canal area, together with other numerous canal enterprises carried out in that period by members of the royal family, noble officials and influential Chinese, was greatly significant in the developmental process of the Delta type of farming system, confirming landownership of the adjoining lands and leading to the development of an extensive absentee landlordism aimed at the collection of land rent.

Indeed, the large-scale reclamation which lasted from the 1880's to around the 1920's was of profound socio-economic consequences because it illuminated the destruction of the traditional subsistence farming among the peasants, at least for those in some provinces in the lower part of the delta. In these areas, significant changes under absentee landlordism were brought about, as Walter Graham has written: "the small peasant proprietor tends to disappear, giving place to the great land-owner of the royal family or the nobility, and for this reason ... the old custom of communal labour is falling into disuse, the work being done by large numbers of Lao coolies who come down from the hills every year and hire themselves out for the season" (Graham, 1924: Vol.2,

15). Absentee landlords, mostly resident in Bangkok, rented out large amounts of land to peasants in search of land,at a great profit (Thompson, 1906: 182). Those peasants who became tenants are supposed to have been mainly the landless migrating from the previously developed and densely populated areas in the Depression Belts and the Early Canalled Lowland. Another major group absorbed in reclamation, especially in the Rangsit canal area,were Lao-speaking peasants who had seasonally migrated from the North-east (Isan) to be employed in harvesting and transplanting and subsequently settled in the area as tenants or rural labourers.[25] In addition there seem to have been a great number of debt slaves or that who had to continue to work on their landlords' estates without pay until they redeemed themselves from servility at their individual redemption price (kha tua).[26] It may be suggested that after the abolition of slavery in 1905, some of these that became tenants and some remained landless rural labourers or simply fled due to heavy debts.

Under the absentee landlordism which spread rapidly from the end of the nineteenth century with the development of reclamation, land disputes between tenants and landlords or their agent, nai kong, arose in various areas. In the Rangsit canal area in particular, many tenants suffered acutely from exploitation by landlords, as a large number of documents record. An inquiry into landownership relations in this area by the Ministry of Interior in 1906, for example, cites cases of arbitrary increases in land rent by landlords and increasing impoverishment of tenants under intolerable burdens of indebtedness and high land rent (K.S. 3.1/11). In order to meet the cash expenditures in production, the tenants frequently had to borrow money from the landlords at extremely high rates of interest. When the crop failed and

they could not pay the rent or interest, landlords refused to reduce rents, and a considerable number of tenants simply fled away. Large estates owned by great landlords in the area, as a consequence, perpetually suffered from labour shortage at the beginning of this century. At the time of Zimmerman's survey in the Rangsit area, there remained extensive poverty under the great absentee landlords throughout the 1930's (Zimmerman, 1931: 305) and this has continued to exist even in the post-war period.

Tenancy under the great absentee landlords has survived up to the present, notably in the five provinces of Pathumthani, Nakhon Nayok, Chachoengsao, Ayutthaya and Samut Prakan. According to a record of the Department of Land in 1948, cited by Pringle et al. (Table 16), great landlords owning over 1,000 rai numbered 153 in the delta farming region, most of them in these provinces. As for the situation in 1969, Krirkkiat gives detailed data of 127 great landlords in the four provinces, citing their names, addresses and size of holdings. Between 1948 and 1969, the number of landlords increased considerably in the three provinces, while Pathumthani province shows a decrease from 54 to 18. In the four provinces the area of land owned by the great landlords in 1969 amounts to 363,130 rai. Taking figures in 1973 in place of those unavailable in 1969, it accounts for 7.6 per cent of the total land under tenure and 13.3 per cent of the total land rented in 1974. Most of these landlords are wealthy individuals including members of the royal family and high-ranking officials, some companies such as Siam Canals, Land Irrigation Company and some Ministries, of which the biggest landlord, a late royal descendant, maintains a holding of 52,129 rai in 256 plots. Besides these, there is a fair amount of royal demesne or thidin sapsin suan phramahakasat (land owned by the king), most of which is riceland customarily

TABLE 16: Major Absentee Landlords in Four Provinces of the Chao Phraya Delta

Province	No. of major landlords owning more than 1,000 rai		Land owned by major landlords in 1969		
	1948*	1969	Area (rai)	% of total land under tenure 1973	% of total land rented 1973
Chachoengsao	23	39	102,084	6.26	13.37
Nakhon Nayok	33	41	97,836	10.89	19.34
Ayutthaya	17	29	84,370	5.89	10.04
Pathumthani	54	18	78,840	9.37	12.73
Total	127	127	363,130	7.56	13.31

* Number of major absentee landlords in the delta provinces other than the four provinces listed in the Table are as follows: Samut Prakan: 10; Saraburi: 6; Nakhon Pathom: 6; Samut Sakhon: 2; Samut Songkhram: 2.

Source: Pringle et al., 1952: appendix A; Krirkkiat, 1978: 193-201.

called na luang, or royal riceland,[27] and has been leased to individual peasants under the jurisdiction of the Office of the Crown Property from the turn of the century. However, most of the na luang existing in the delta and adjacent areas, amounting to about 50,000 rai, were granted to the Office of Land Reform for Agriculture as resources for land reform in 1975, in the face of the rising peasant movement and general atmosphere for land reform.[28] The kings were actually great landlords in the delta since the end of the nineteenth century.

Apart from absentee landlords, small-scale renting between petty local landlords and tenants is also a notable feature of tenancy in the Delta type of farming as it is in the intermontane basins. Local landlords owning about 50 to 200 rai, but rarely exceeding that figure, rent out a part or sometimes all of their holdings to villagers in the same or nearby villages. They are basically village dwellers working a part of their holdings or retired from farming due to old age and other reasons. Distinguished from tenancy under absentee landlords which has developed in close relation with the urban capitalist sector and, in some areas, rooted in speculative accumulation of land during large-scale reclamation, small-scale renting by local landlords is basically a result of the development of peasant farming by rich households. Where absentee landlordism has developed extensively over vast tracts and absorbed small holdings as mentioned above, small-scale tenancy under local landlords tends to be rather rare and underdeveloped. Although it does, of course, prevail all over the delta region to varying degrees, it is relatively dominant in the Old Delta Proper and the Depression Belts and other areas in the lower delta other than those under the great absentee landlords.

As for small-scale renting between kinsmen, which is characteristic of the intermontane basins, many instances may be also observed in the above areas. The conditions of renting among kinsmen vary considerably according to place, from free-renting, under the condition that the tenant family will assist the landlord in the high labour demand periods, to the same conditions of rent payment as those of non-kinsmen. Particularly between the landowning parents and their married children with independent households, free-renting based on reciprocal labour relationships may frequently be observed in some areas, mainly in the Old Delta Proper and the Depression Belts (Tanabe, 1979b: 12-14). In many cases of this type the plot occupied and operated by a son or daughter is generally presumed to be bequeathed to them in the future. Although legal ownership normally rests with the parents until their death, a plot cultivated by a child with parental consent is customarily considered to be occupied (khrɔp khrɔng) by him or her.[29] The free-renting of land between parents and children is indeed one stage in the transition of landownership from parents to progeny and therefore it should be distinguished from tenancy in general. In the intermontane basins the reciprocal relationship in the utilisation of land and labour between parents and their progeny is more often practised as a real tenancy than as a transitional period in kin relations. In the delta, on the other hand, the reciprocal relationship tends to be expressed through labour supply by progeny to the parents in return for the occupancy of a part of the latter's holdings.

It is probable that most land rents in the region are still paid in kind, though compared with the intermontane basins, the incidence of cash rent has increased in recent years. Although rent is highly variable from place to place, in the 1970's fixed rent in kind, the

most popular means of payment, ranged roughly from 8 to 20 thang per rai, which may be equivalent to 30 to 50 per cent of the gross product, while fixed rent in cash is between 80 and 250 baht per rai or roughly from 20 to 45 per cent of the gross product (Chaiyon and Suthiporn, 1974: 10; Kitahara, 1974: 32).[30] These fixed rents in both kind and cash tend on the whole to be increasing over the years. Sharecropping, which dominates in the intermontane basins, seems here to be rather in the minority with the rents between a half or a third. It is still practised in the areas more prone to crop damage from flood or drought, because it can prevent both landlords and tenants from incurring heavy losses in the case of crop failure (Amyot, 1976: 104). With respect to the rents levied, there seem to be some differences between the rates charged by absentee landlords and petty local landlords. In the case of Bang Chan, the rents charged by the latter are higher than those charged by the former (Sharp et al., 1953: 148; Kamol, 1955: 67).[31] Since there are few data dealing with landlord-tenant relationships, it cannot necessarily be said that such discrepancies in the rate of rents can be applied throughout the delta region. However, as Sharp et al. pointed out, local landlords are likely to be in a better position to manipulate the competition for land among tenants than are absentee landlords outside villages, so that the former tend to be quicker to adjust the rate to their own profit (Sharp, et al., 1953: 148).

Given the predominance of commodity production and the widespread penetration of money economy, wage labouring has been quite common among most peasants including tenants, part tenants and even small landowners for many decades. Compared with the intermontane basins, cash cropping of crops other than rice is minimal in the delta,

except for the recent development of maize cultivation and other upland cropping on the margins of the region. For most operating households, it has been a common practice to seek wage labouring opportunities in both agricultural and non-agricultural sectors, in order to cover the deficit arising from increasing household expenditure, especially in the case of crop failure and falling paddy market prices. Most households of tenants, part tenants and owner-operators with holdings of under 25-30 rai usually contain some members who seek supplementary income from wage labouring both inside and outside the village community.

Leaving aside wage labouring in general, as seen in the intermontane basins, there seem to be a great number of peasant households who may be termed 'rural labourers', who make their livelihood principally by wage labouring throughout the Delta farming region. These households are called, to distinguish them clearly from operating households, khon rap čhang in the same way as in the intermontane basins. Although, as in the case of the intermontane basins, there are few sources indicating the magnitude of such people in the delta region as a whole, some community studies have pointed out the existence of a considerable number of rural labourers in the village communities.

In the early 1930's Zimmerman already refers to a mobile population of poor peasants who had been forced out of cultivation and fled away as a result of expropriation by absentee landlords and moneylenders in the newly reclaimed Rangsit canal area (Zimmerman, 1931: 306-307). According to Kamol's study in Bang Chan, there were 27 rural labourers' households or 10.5 per cent of 256 farming households in 1949, and their numbers increased in 1953 to 38 households or 17.6 per cent of 254 farming households (Kamol, 1955: 45). Piker mentions the existence

of quite a large number of households, accounting for nearly 56 per cent of the total, dependedent largely upon wage labouring in a village of Ayutthaya province studied in the 1960's (Piker, 1976: 19). For the early 1970's, Fuhs indicates a growing number of rural labourers and the considerable disparity in household income between those households and operating households in some villages of the same province (Fuhs, 1976: 204-205). Kitahara's survey in a village of Nakhon Nayok province in 1971 revealed that the rural labourers, constituting 14 households out of a total of 80, were considered to be of a lower status than operating households, and that a considerable number of them were descendants of rural labourers going back many generations (Kitahara, 1977: 138, 141). Whatever the case, there is little doubt that most village communities in the delta contain a considerable number of landless rural labourers, perhaps amounting to around 20 to 30 per cent of the total farming households.

Despite the early appearance of the Lao migrant labourers and descendants of debt slaves and their subsequent survival, the present growing population of rural labourers seems mainly to derive from stratification of peasants within village communities. The great mass of rural labourers underwent reduction in status in the highly commercialised agrarian society of the delta during the depression of the 1930's and in subsequent periods. Against the background of a rapid growth in population, possibilities of peasant reclamation have become increasingly narrow throughout the delta in recent years, and virtually closed with the last large-scale expansion of arable land in the Old Delta Proper in the 1960's. At the same time there has been a steady process of, on the one hand, accumulation of properties by absentee landlords and even the rich peasants in the villages, and on the

other, the growth of heavy indebtedness among smallholders, leading to the loss of their holdings during the past few decades.[32] The majority of landless rural labourers currently remaining in villages are those who have lost their holdings, who have inherited no land and who can rent no land at all due to high competition for tenancies.

The great mass of rural labourers, as in the intermontane basins, are basically engaged, to a greater or lesser degree, in wage labouring on farms both within and outside their own villages, together with that provided in the non-agricultural sector. Reflecting the larger holdings in some areas such as the Rangsit and the adjacent areas, here there have been, in addition to piece-workers and day-labourers, some regular hired labourers or luk čhang hired by rich operating households for all or part of the farming season with fixed wages. According to Kamol's study in Bang Chan, there was a good number of this kind of regular labourer living in their employers' house in the early 1950's (Kamol, 1955: 75). However, the greater proportion of rural labourers commonly seen throughout the delta region today are piece-workers or day-labourers who are not hired by specific households under regular contract, but receive wages on the basis of piece-work or on a per day basis. The major tasks to be carried out by these labourers are such works as uprooting seedlings, transplanting and harvesting, which have been accomplished traditionally with the reciprocal labour exchange of ao raeng. The demand for hired labour has generally occured in substitution for traditional labour exchange within the framework of the existing farming technology. In addition to this basic substitution, there seems also to have been a change in the traditional supply of hired labour, especially in the newly reclaimed areas. The seasonal migration of Lao labourers from the North-east to these areas has

steadily declined to be replaced largely by a growing population of native labourers from the village or nearby. In some areas of the Retarding Basin, however, where Lao labourers were once predominant at harvesting time, today seasonal migrant labourers from inside and outside the delta are now hired in substitution for them.[33]

Owing to the shift from broadcast-sowing to transplanting, and the development of off-season cultivation, though restricted to a quite small area, there seems to have been, to some degree, an increasing opportunity for casual employment in various farming tasks in recent years. In many areas the increasing adoption of transplanting cultivation has come to provide piece-work tasks especially in uprooting and transplanting, which tend to be carried out mainly by local labourers rather than by temporary migrant labour. In a village of Singburi province where double cropping was introduced under the recent land consolidation, these tasks in the rich operating households are accomplished exclusively by rural labourers from inside the village and other nearby villages, and there are even cases where the operating household contributes no domestic labour (Tanabe, 1979b: 8, 18). However, despite the increasing opportunities in rice cultivation, there is still a serious unemployment problem among the majority of rural labourers, especially during periods other than transplanting and harvesting. Most rural labourers have to search not only for agricultural work but also for every kind of casual employment available in both the countryside and district and provincial towns. This employment in the non-agricultural sector includes wage labouring at construction sites of both government projects and urban capitalists' enterprises, and such miscellaneous casual jobs as carpentry, fishing, selling food or groceries, sailing and tricycle (samlo) driving in towns.[34]

With respect to the general conditions of employment there appears to be a considerable difference between the delta surrounding the metropolis of Bangkok and the remote intermontane basins with a few smaller urban centres. As shown in the population data, there has been a continuous large flow of rural population to Greater Bangkok (Bangkok-Thonburi) especially from the delta provinces in recent years (ILO, 1965: 40-42; Ng, 1969: 725-729; Sternstein, 1979: 33). There is little doubt that, in addition to the migrants who become settled in the metropolitan area, a fair number of rural labourers temporarily move there to seek employment opportunities for wage labouring, while during the busy season in farming they may go back home. As we have discussed earlier, most rural labourers in the intermontane basins remaining in their villages are currently forced to operate shifting cultivation and other subsistence activities in the 'forest reserve' for their survival. By contrast, there is a clear tendency for some of those in the delta region to cease to be peasants, rather joining the urban working class.

4. Conclusions to Chapters III and IV

In this and the previous chapter, we have attempted to reveal two types of peasant rice farming system long established along the Chao Phraya water system, namely the Intermontane Basin type and the Delta type. The first type represents subsistence oriented farming based on the traditionally developed müang fai irrigation system and an elaborate transplanting method of cultivation in the northern intermontane basins; the second type covers the highly commercialised farming of petty commodity production developed within the Chao Phraya delta, where natural precipitation and annual inundation are the main

traditional sources of water supply, and the transplanting or broadcast-sowing method is applied according to water conditions. This typology is primarily intended to present the bare outlines of the regional characteristics of the two farming systems in the ecological context, particularly in the interrelationship between the given environment and technology, in order to facilitate further detailed discussion.

Even in such general terms, however, it may be possible to point out some major characteristics of the two farming systems from a comparative point of view. Needless to say, the two farming systems have been established in quite different and contrasting physical environments. The rice-growing peasants in both regions have accordingly responded significantly differently to the given environment in the course of agricultural adaptation. Although the rice cultivation itself, as already discussed, essentially entails great alteration of the natural environment, the degree of peasants' involvement in the alteration differs considerably between the two regions. For example, the müang fai system, the crucial facility of the Intermontane Basin type of farming, is the result of immense land alteration through a continuous and massive input of peasant labour, while the Delta type of farming, almost entirely lacking such facilities, has chosen rather to depend on and respond to immutable nature. As for farming technology, the former system has well-maintained smaller plots in the irrigation terminal networks and elaborate nursery beds, all of which features indicate a steady alteration of the cultural landscape over the years. Conversely, all technological attributes of the latter system such as extensive plots subject to annual inundation, broadcast-sowing and the selection of 'floating rice' for the prolonged deep flooding area, clearly

indicate peasant farming on less modified land which is relatively undeveloped and where uncertainty of rain and nam thuan predominate. Such contrasting response to the land necessarily leads to differentiation of the two farming systems not only in land productivity but also in various aspects of socio-economic conditions.

Obviously, the differences in the peasant response will be revealed in the amount of labour input in irrigation management and in a whole series of farming operations. The massive labour input in annual repairs to fai and müang, which is necessarily imposed on the peasant cultivators in most smaller müang fai systems outside modern state projects, presents a striking contrast to total dependence on rain and inundation, particularly in broadcast-sowing cultivation in the delta. As many studies have shown, the total amount of labour required in the course of cultivation varies from place to place according to the cultivation method (Hanks, 1972: 54-66; Calavan, 1977: 88-108). The amounts of labour input in transplanting are not so different between the two farming systems. However, with its nursery culture and laborious work in uprooting and transplanting, the highly labour-intensive character of the transplanting culture prevailing in the intermontane basins is quite conspicuous, compared with the broadcast-sowing cultivation in the delta, in which little is attempted from sowing until harvest.

In addition to the amount of labour input, one of the most important contrasts is related to the labour resources supplied in irrigation and farming operations. In irrigation the peasants in the intermontane basins have traditionally organised themselves into a highly co-operative mu fai to meet heavy and intensive labour demand from the annual repairs in order to attain efficient irrigation management.

Conversely, irrigation by water-raising devices, if necessary, takes place only on an individual basis in most areas of the delta. It is one of the major characteristics of rice cultivation that household labour, which is the basic labour resource, must be supplemented by outside resources during the periods of peak labour requirement such as transplanting and harvesting. There is little doubt that traditional reciprocal labour exchange, called by various terms according to the region, has fulfilled a significant role in making such a requirement throughout the country. Although this traditional arrangement of labour exchange has tended to be replaced by hired labour in most parts of the country under the increasing predominance of the money economy in recent years, it is still widely practised in the countryside of the intermontane basins. In the delta, on the other hand, the practice of hiring labour already began early in this century and labour exchange has almost disappeared at the present time. All these inquiries respecting the relationship between technology and labour utilisation will be revealed as a sharp contrast between the two farming systems by investigating the actual data in the selected villages in the later chapters.

The technological contrast in irrigation and farming operations is also reflected by the utilisation of land resources in the two farming systems. The labour-intensive cultivation in the intermontane basins may be attributed to the small farm size, primarily aiming to fulfil subsistence needs; while the less labour-intensive cultivation on the relatively large farms of the delta is related to the region's petty commodity production where a considerable amount of production in a household is assigned to the market. However, it should be noted that despite such different orientations, the basic character

of the economy in both farming systems still remains that of a peasant economy in which the domestic consumption needs of the family dominate over profit making.

Despite such differences in farm size and associated economic aspiration, there has been a growing tendency towards inequality of land holding among peasants in both regions, particularly during the past few decades. However, reflecting the historical process of land reclamation, recent technological changes and the degree of penetration of the money economy, there are differences in the nature of the disparities in land holding.

In both farming systems we find tenancy associated with both absentee landlords and petty local landlords. In the delta, absentee landlordism originally developed in the process of large-scale riceland reclamation, which took place extensively in the Young Delta at the close of the nineteenth century. This has been also reinforced through the accumulation of land by urban-based capitalists, a phenomenon which has particularly progressed during the past few decades. However, in the intermontane basins, far away from the centre of the export rice market, the early accumulation of large holdings occured only sluggishly and on a smaller scale. On the other hand, the small-scale renting of petty local landlords which prevails widely in both regions, is basically the result of the development of peasant farming by rich households. In particular, in the intermontane basins small-scale renting practised among kinsmen, particularly between parents and their children, is widespread and is also observed in some areas of the delta region. Although there are many variations in renting conditions, this type of renting is principally based on a reciprocal relationship in utilisation of land and labour between parents and children especially during the

transition of landownership from the former to the latter.

Taking all these characteristics of tenancy into consideration, we need a more careful analysis of the land tenure situation particularly in relation to utilisation of land and labour in the individual peasant household. In addition to the development of tenancy there is little doubt that almost every village in both regions contains a considerable number of rural labourers. They have emerged basically from a reduction in the status of smallholders and seem to be beginning to form themselves into a distinct category of peasantry within village societies. Under the traditional technology of rice cultivation, employment opportunities for wage labouring seem normally to occur only as a substitute for declining labour exchange arrangements. So far as rural labourers remain within village communities for lack of employment in the non-agricultural sector, their lives are strongly dependent on the pattern of labour allocation under the traditional farming technology. Thus, in order to elucidate the current situation of rural labourers and land tenure problems, we have to take up again the investigation into the pattern of land and labour utilisation in individual peasant households, which is bound up with the traditional farming technology. All these inquiries associated with land and labour utilisation will be pursued in the village context in later chapters.

The typology of peasant farming systems discussed above is merely an attempt to identify some tendencies at the regional level and further inquiry would undoubtedly lead to a more comprehensive formulation of the typology through comparison with other different ecological settings; further comparison with rice cultivation on marginal fans and terraces outside the delta, and that practised on the Khorat plateau in the

North-east might serve to reveal more similarities and differences among types, but this is beyond the scope of this study. It would be also possible to give more indication of intra-regional variations by accumulation of the empirical cases of village studies and arranging them along a typological continuum. Although such an attempt would certainly contribute to typological elaboration and a more dynamic grasp of peasant farming systems between the ideal-types at the extremes of the continuum, it is extremely difficult at present mainly due to scarcity of reliable data, especially those concerned with the technological and social aspects of farming in villages.

Here, however, our main concern is not the typology itself but the structure of farming systems and changing aspects of a complex with which peasant households and social groups are currently confronted, rather than the regional content of farming systems. The notion of typology always implies a sort of structure, as we have shown in generalisation of the two farming systems. In the study of peasant farming systems, however, a generalised type and its structure is liable to fail to grasp reality which lies, in fact, in actual labouring on the individual plot within such frameworks as household, village community and the outer world. The circumstances in which peasants manipulate the existing sets of relationships and resources under a particular ecological setting through their own technology, including decisions with traditional norms and values, can only be effectively understood through investigations and interpretation in the household and village contexts. The following chapters, therefore, focus narrowly on analysis and interpretation of rice cultivation practised in the two villages under contrasting ecological settings. It is thought that the microscopic view is essential if the general typology is not only to have a factual basis but also to elucidate the structure of peasant farming.

CHAPTER V

CHIANGMAI AND AYUTTHAYA: THE CONTRASTING VILLAGES

The main purpose of this chapter is to show the general contrasts of peasant socio-economic life between Chiangmai village and Ayutthaya village, which were selected in radically different ecological settings for intensive field research to examine the two farming systems at the village level. After a brief discussion of the methods and criteria in the selection of the two contrasting villages, we examine the general background of rice farming and peasant life in relation to the location of each settlement and its rice field, and the major characteristics of the village community. This is followed by an attempt to trace the historical background of the villages, especially focusing upon settlement and land reclamation in the pioneering and subsequent periods. Finally, in order to give a general picture of the contemporary socio-economic conditions, we shall discuss the occupational structures, land tenure situation and rice production in comparative perspective. The examination of the historical and contemporary aspects of peasant life in this chapter will illuminate some major problems of peasant farming in the light of comparative perspective, and will facilitate further discussion in the subsequent chapters in the context of farming technology, land and labour.

1. The Contrasting Villages

In the foregoing two chapters, we have attempted to demonstrate the existence of and the contrasts in the different farming systems which have long been established in the major rice-growing areas, in terms of their different ecological settings. Taking into account the generalised characteristics of the farming systems, we shall, hereafter, concentrate our discussion on the evidence of peasant farming mainly based on field-work data obtained at the two villages in 1974 and 1975. There is little doubt that any attempt to discover internal relationships in a farming system requires a close field investigation into the actual farming operations, their associated social customs, and their effect upon socio-economic factors. Since peasant farming is essentially performed by individual households within a village community as the most immediate framework to which they belong, this could be attained only through an intensive observation and careful interpretation of peasants' activities in such a framework (Shanin, 1973 : 72-73). Although the peasant farming systems as shown in the previous chapters, undoubtedly have spatial extension as farming regions in terms of their ecological and technological settings, sets of relationships and resources which peasants mobilise and manipulate through their own technology can be ultimately demonstrated in the context of household and village.

Taking into account this central requirement in a study of peasant farming, we intend to show contrasting characteristics of the two farming systems through comparison of the selected villages. For the study of farming systems, especially dealing with the relationships between physical environment, technology and socio-economic conditions, it is highly necessary to take a comparative perspective. As Steward, and most explicitly Geertz emphasise, any attempt to discover broader

generalities in such relationships must preferably be made in comparative perspective under given ecological settings (Steward, 1955; Geertz, 1972: 23-24). This methodological perspective should be of great importance, particularly in dealing with peasant farming technology, as Farmer realised in his comparative technology (Farmer, 1968: 202). The farming systems which are essentially evolved in the household and village context can be understood much more clearly when they are investigated in the light of comparative perspective. Thus in the subsequent chapters, our attempt will try to give a differentiated picture of peasant farming systems and will be focused on the two villages situated in the Intermontane Basin and the Delta farming regions, by comparing the data of those two villages.

Taking these methodological considerations into account, selection of villages was made with special emphasis upon the contrasts in physical environment and traditional farming technology, centred around irrigation and cultivation methods. Since the traditional technology is thought to have been acquired essentially as a crucial part of the Thai culture, a general survey for selection of villages was conducted in culturally and historically important areas in the two farming regions, i.e. Chiangmai, Lamphun and Chiangrai provinces for the Intermontane Basin type, and Singburi, Ayutthaya, Suphanburi, Nakhon Pathom and Pathumthani provinces for the Delta type. In the course of village selection three major criteria were taken into account as follows: (1) ecological contrast, especially in water availability, which governs farming technology to be employed as a whole: in this respect preference was given to the tributary valleys and alluvial fans, where water is relatively abundant and controllable in the intermontane basins, and the Retarding Basin of the delta area, where deep and

uncontrollable flooding is predominant : (2) contrast in irrigation method and its management: in the intermontane basins, the villages in which a traditional müang fai system and its social organisation are still at work was preferable to those included within a modern State Irrigation Project, while the deep flooding areas of less complex water control would lend sharp contrast to the former; (3) contrast in traditional farming operations: cultivation methods would be largely determined by the above differences in irrigation environment, with transplanting in the former area and broadcast-sowing in the latter. Yet the selected villages should preserve, to a substantial degree, traditional technology, and should not be greatly influenced by modern technical improvements.

In addition to the above criteria in the ecological and technological context, village selection involved two other considerations in relation to socio-economic conditions in general. (1) The villages as agricultural communities based on rice production: the villages to be studied in both farming regions had to be agrarian communities consisting of a substantial number of farm households mainly devoted to rice cultivation. With respect to occupation structure and land-use pattern, urban influence upon the villages should be moderate, and therefore they were likely to be located at some distance from major towns, though too isolated and remote villages were to be avoided. (2) The land tenure distribution should not be extreme : in order to facilitate wider examination of various kinds of land tenure status, the villages to be selected were to consist neither of too many owner-operators nor of too many tenants. Particularly in the delta, the areas where absentee landlordism has become widespread might be inconvenient for observing the situation of small holders and their individual reclamation of land,

though of great importance in the study of land tenure itself.

After consideration of all these criteria as well as other logistical aspects, the two villages were eventually selected in Chiangmai and Ayutthaya provinces, i.e. Nǫng Plaman (Village No.2), Tambon Huai Sai, Mae Rim district of Chiangmai province and Ton Tan (Village No.9), Tambon Bang Nomkho, Sena district of Ayutthaya province. In the following sections we shall give a brief general description of the two villages in order to facilitate further discussion in subsequent chapters.

2. Chiangmai Village in the Intermontane Basin

(1) Chiangmai Village

From the north gate of old Chiangmai city, called the Gate of the White Elephant (pratu chang phüak), an old highway runs northward up to Fang on the border between Thailand and Burma. The Dǫi Pui mountain range, in which the Dǫi Suthep mountain with the famous Buddhist monastery of Wat Phrathat on its slopes is included, stretches west along the highway. This highway runs across the edge of many small alluvial fans which are formed by streams flowing down from the mountain range. The Chiangmai-Fang highway, passing through a few settlements located between the alluvial plain of Mae Ping main channel to the east, and a series of alluvial fans to the west, reaches a local town, Mae Rim, 14 km from the Gate of the White Elephant (Figure 12).

Mae Rim is also the name of the district or amphoe. Also, the town where the district office has been established is precisely called Tambon Rim Tai, tambon being the next smallest administrative unit to amphoe. Mae Rim is a typical local centre and has a district police station, a post office, a high school, an agricultural co-operative office, and a

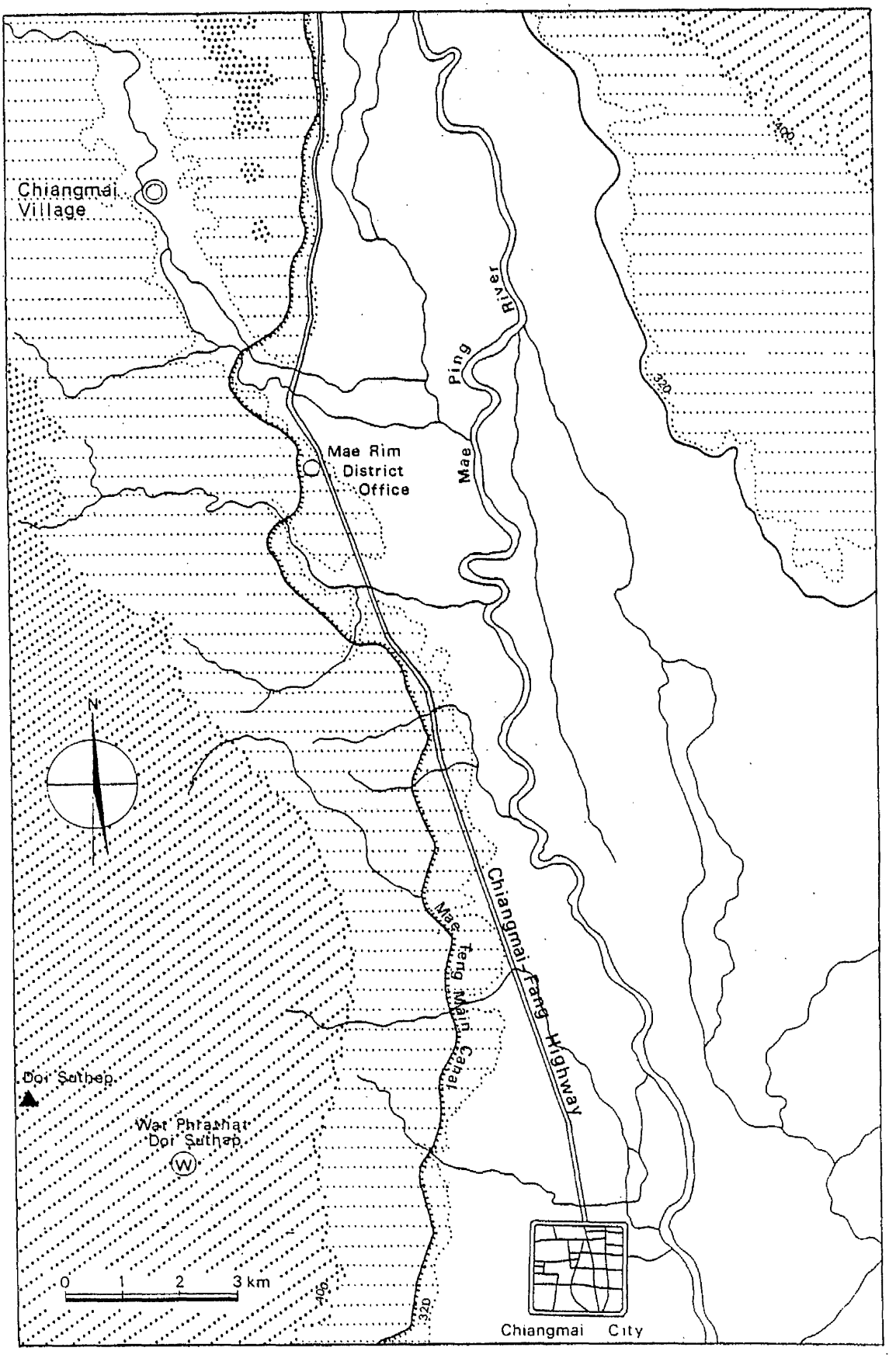


Figure 12: Map Showing the Route from Chiangmai City to Chiangmai Village

bank together with the Mae Rim district office. At the same time, it has also been a centre of market exchange among the peasants coming from nearby tambon. In front of the district office are the morning and evening markets which consist of a number of peasant traders involved in trading on a small scale, as well as retail shopkeepers. Mae Rim town fulfils the economic functions of a marketplace, but the peasants living in most of the tambon in this district, now have ready access to the larger markets in Chiangmai city area. Because of recent improvements in transportation on the highways, the peasants relatively near to the Chiangmai-Fang highway can go to and from Chiangmai city area within an hour.

About two kilometres from the town, the highway runs across the Mae Rim river, a tributary of the Mae Ping main channel from the northwest, and comes to Tambon Rim Nüa. Mae Rim town and Tambon Rim Nüa are situated at the mouth of Mae Rim valley and occupy a contact point between the tributary valley and the fairly open terrain of the Mae Ping's alluvial plain (Figures 13 and 14). Here, a narrow dirt road branches off the highway to the northwest. Immediately beyond the hamlets of Rim Nüa, the road passes above the Mae Taeng irrigation canal which crosses over the full width of the valley by means of a modern concrete bridge. This huge scale irrigation canal is a part of the Mae Taeng irrigation project,[1] one of the vast state projects which was completed at an enormous cost of three million baht, mostly under the aid of the United States Agency for International Development. It aims chiefly to supply irrigation water for about 150,000 rai (24,000 ha) on the west bank of Mae Ping from Amphoe Mae Taeng to Amphoe San Patong (Figure 4). As yet, however, the villages in the Mae Rim valley have not benefited at all from the project and are

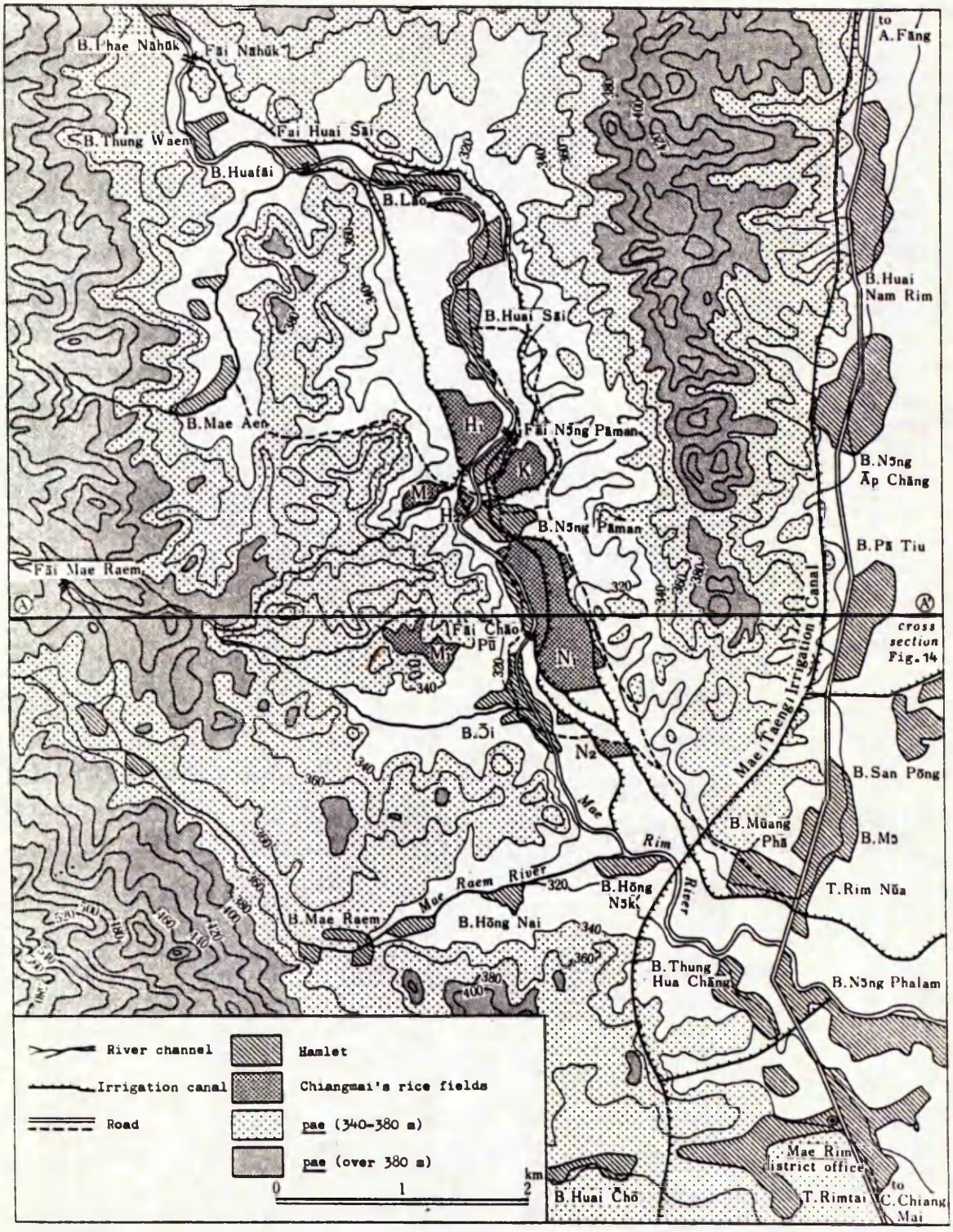


Figure 13: Chiangmai Village in the Mae Rim River Valley

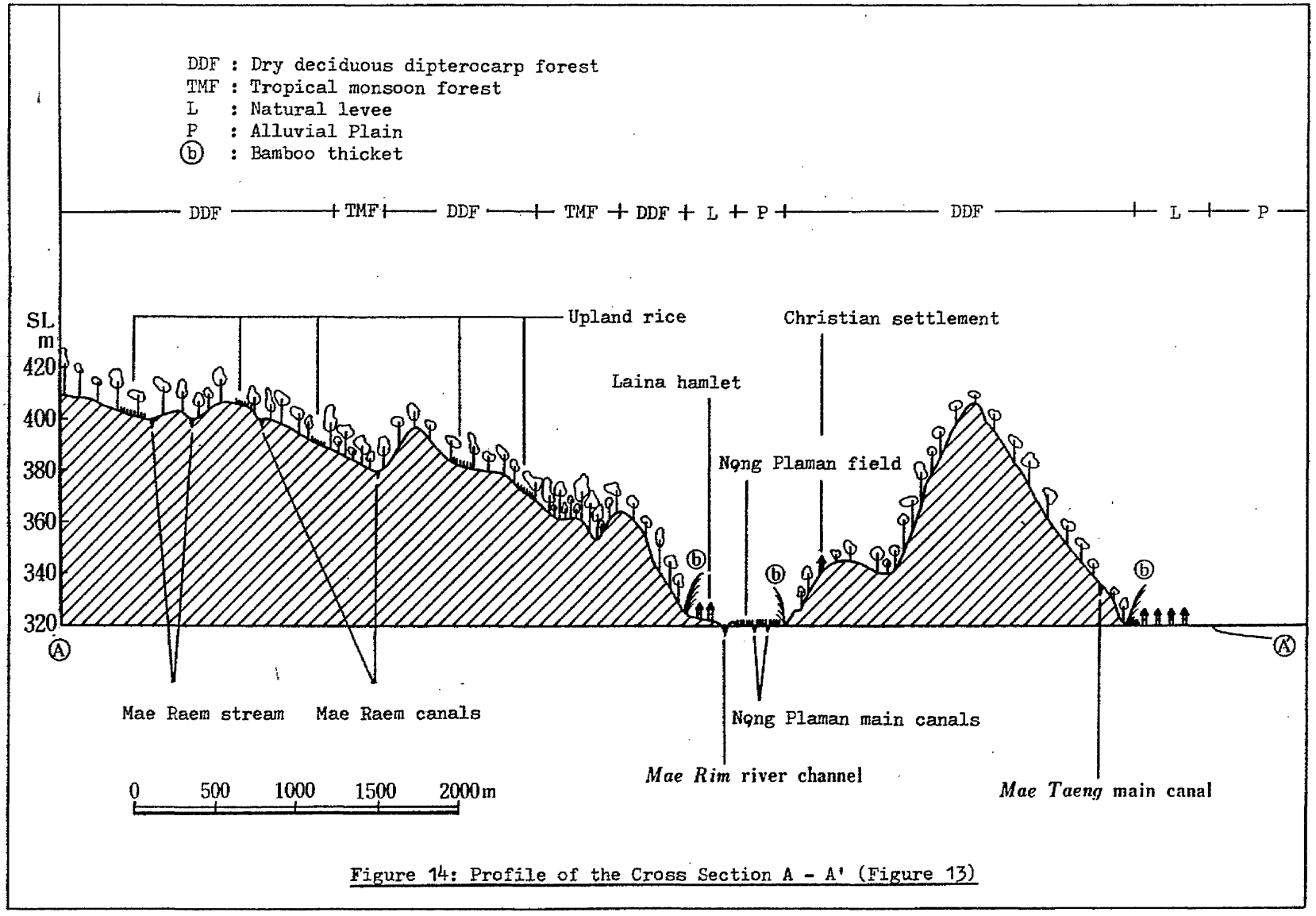


Figure 14: Profile of the Cross Section A - A' (Figure 13)

left untouched by modernisation and are dependent on their traditional methods of rice-growing. Although electricity supply, commonly regarded as a symbol of rural modernisation, has been available since the opening of the main canal, it does not reach the villages beyond Tambon Rim Nüa.

Passing the Mae Taeng main canal, the road runs along the edge of pae covered by dry deciduous dipterocarp forest, and the rice fields stretch along the Mae Rim river on the left. The surface of the deeply rutted road indicates laterisation: traffic raises clouds of dust during the dry season. In the rainy season, by contrast, the thick muddy surface obstructs ox-carts (lo ngua) and motor traffic, which is sometimes held up by sudden floods. The road enters a typical well-irrigated rice-growing village located 5 km away from the main highway and about 20 km from the Gate of the White Elephant. Hereafter, and for the sake of convenience, this village will be called Chiangmai village.

Chiangmai village (Nong Plaman or Village No.2) is, in terms of local administration, a part of Tambon Huai Sai, a higher administrative unit together with three other villages, each having a proper name and identification number, i.e. Qi (Village No.1), Huai Sai (Village No.3) and Mae Aen (Village No.4). Tambon Huai Sai consists of those four villages along the Mae Rim valley, containing 695 households and 2,922 population, while in 1975 its largest village, Chiangmai village, had 233 households and a population of 931. Chiangmai village has fairly easy access to the district office at Mae Rim town, so it has established its place in the socio-economic and political function of the Tambon as well as the neighbouring Huai Sai village. Therefore, the Tambon Council (sapha tambon), which discusses and decides important

Tambon matters, is held at Wat Sawang Phet, the Buddhist monastery of the village. A series of festivities among the villagers of the whole Tambon, which is held mainly after the traditional New Year's Day or wan sangkhanlong[2] on 13 April, is also held in the grounds of Chiangmai village school situated in part of the Wat's property. In addition, Chiangmai village has provided places for primary education up to the seventh grade to the children in the whole Tambon for a decade. Thus it may be said that in many respects Chiangmai village is a centre of the Tambon, and is not isolated but relatively open to the outer world of the district town and Chiangmai city.

The village consists of three hamlets founded along the Mae Rim river, i.e. Ban Klang (Central Hamlet), the largest cluster as its centre on the left bank stretching towards the eastern hills, Ban Fai (Weir Hamlet) situated on the left bank in the northern part of the village, and Ban Laina (The Hamlet over the River) stretching on the right bank levees. Ban Klang includes some households along the main road to the south, while on the eastern hills there are twelve households who recently settled there and who form a Christian community and are exclusively rural labourers working on the large fruit estates owned by urban-based capitalist developers. Except for these Christian households of rural labourers, the majority of villagers are Buddhist, and earn their livelihood mainly from rice-growing, or at least are closely associated with it. For these households, Wat Sawang Phet situated in Ban Klang has long performed a central function in integrating their social and religious life throughout the history of the village. It is the religious site for merit-making (tham bun) and various Buddhist rituals and ceremonies which mark the rhythm of peasant life in a

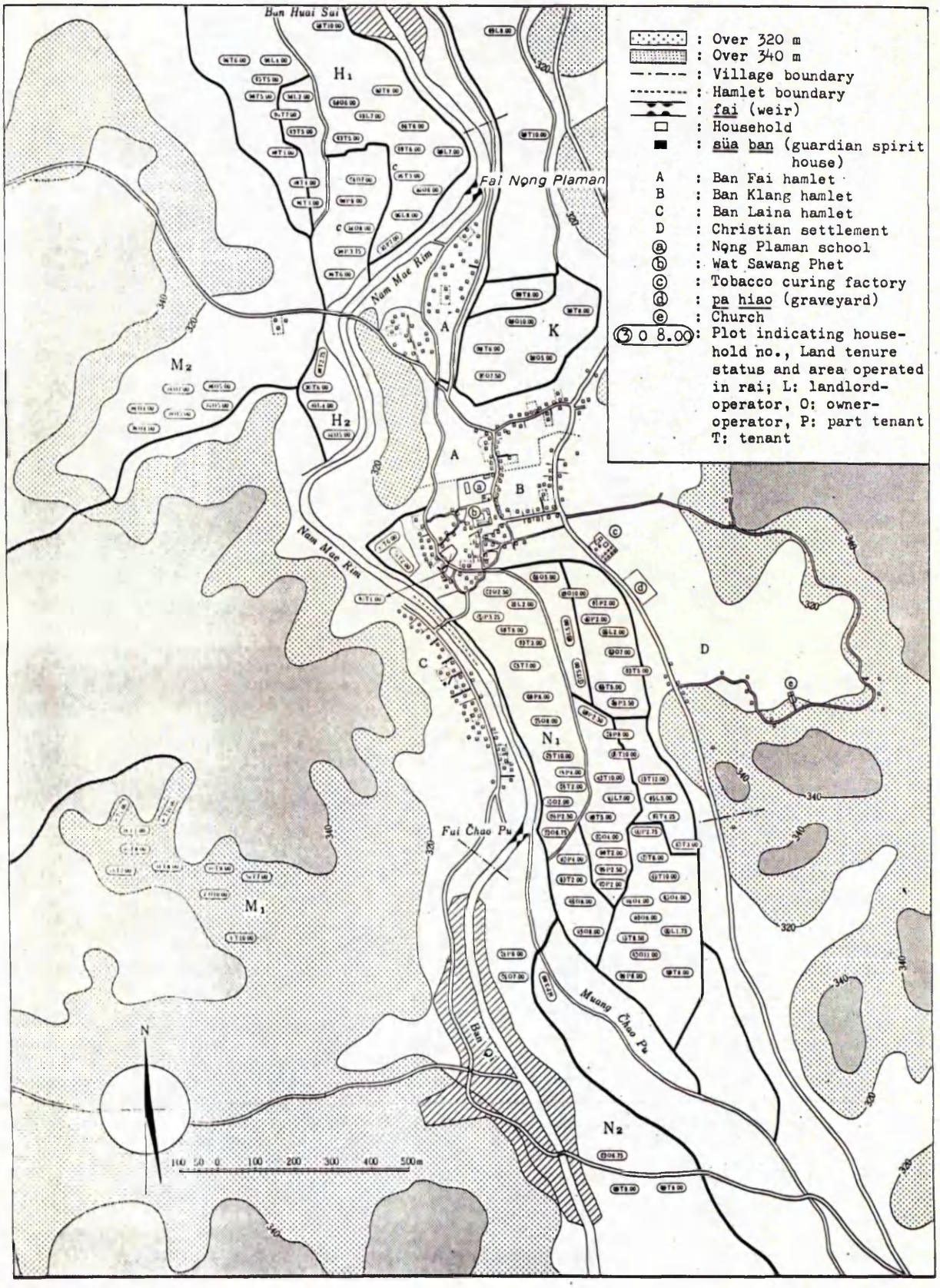


Figure 15: Settlement Plan of Chiangmai Village

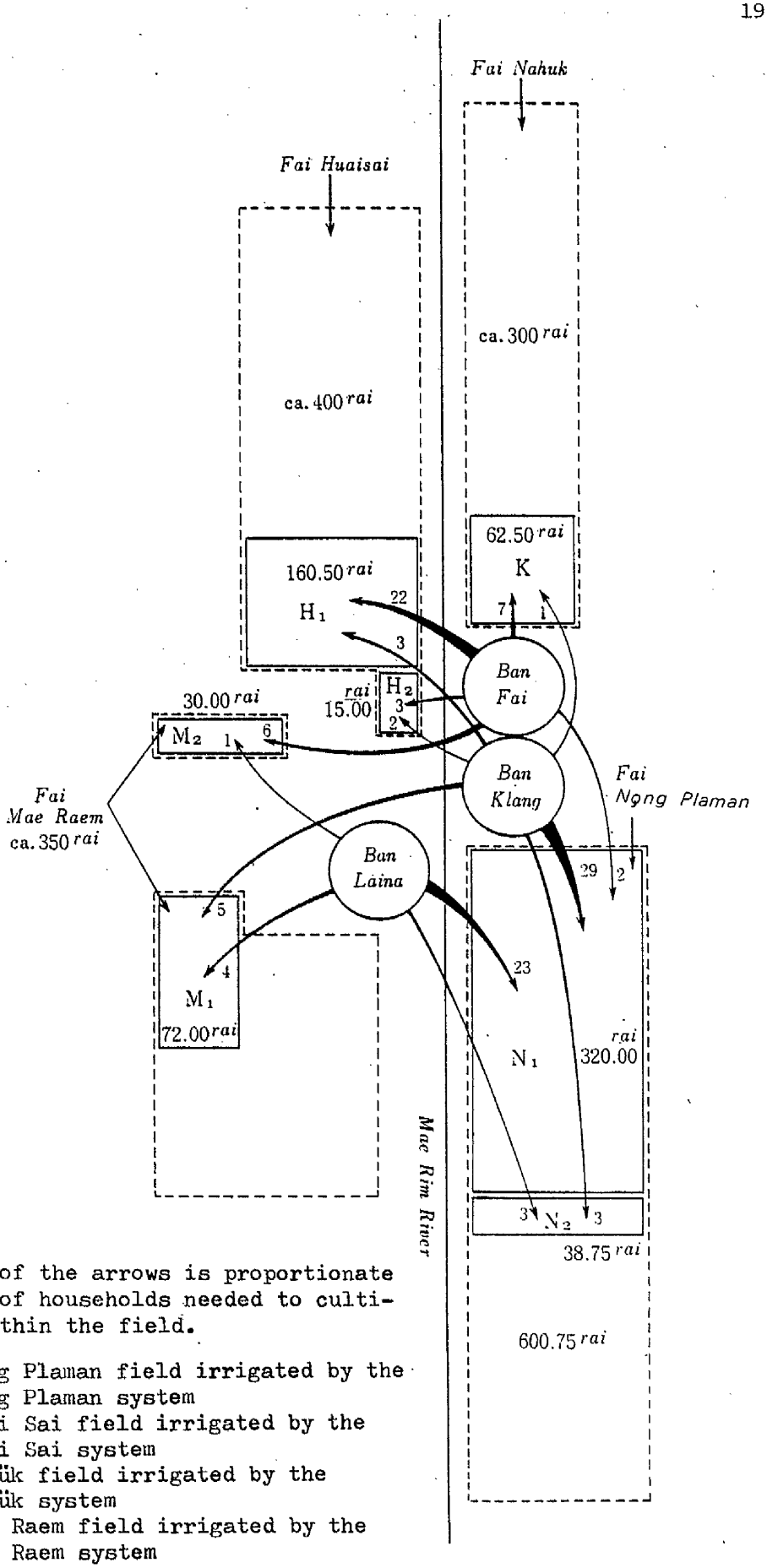
year and a lifetime. Furthermore, it is the social and political centre where meetings to decide important matters affecting the village are held. The Wat maintains the integrity of the village and is the symbol of social identity of every villager living in all three hamlets.

On the other hand, symbolising the neighbourliness of the cluster of dwellings, each hamlet has its own guardian spirit house or sŭa ban to which the guardian spirit of the hamlet or phi ban is invocated in a spirit cult held on the third day of the traditional New Year (15th April) (Tanabe, 1978b: 116-125). In the course of the ritual the phi ban provides an oracle through a possessed medium or ma khi, which concerns various aspects of peasant life of the year, including as its central theme[3] predictions as to rice-growing. In this way, phi ban and its spirit cult, symbolising the land and peasant life of each hamlet, imply the social integrity of a hamlet which may have been a lower level unit of peasant life in the past.[4] However, today, economic, social and political aspects of peasant life, except the spirit cult of phi ban, seem to be largely integrated within the framework of the village community: so far as the process of rice production is concerned, as we shall discuss later, the village has one main mŭang fai irrigation system and its irrigation control group (mu fai) which is organised among the majority of households in the village, though about a half of the total operating households belong to other control groups outside the village; the labour exchange groups (mu ao mu sai mu) which mainly consist of households who operate neighbouring plots, do not usually extend outside the village; various social groups such as the wat committee (khana kammakan wat), the funeral society (samakhom chapanakit songkhro) and the youth club (klum num sao) are

basically organised within the village community.

The ricelands of Chiangmai village stretch along the narrow alluvial valley of the Mae Rim river. The ricelands operated by the villagers are exclusively irrigated fields worked by transplanting, and are divided into four fields or tong according to the müang fai irrigation systems, i.e. the Nọng Plaman field (N1 and N2 in Figures 15 and 16), the Huai Sai field (H1 and H2), the Nahük field (K), and the Mae Raem field (M1 and M2). As shown in Figure 16, these four main fields, being related to the courses of irrigation canals, are further divided into smaller units. The Nọng Plaman field, stretching from the south of Ban Klang up to the east of Ọi village along the east bank of the Mae Rim river, is the largest field, measuring 358.75 rai (57.4 ha), and accounts for nearly a half of the total area operated in the village. This field, including a smaller compound (N2) located within the territory of Ọi village further south, is irrigated by a müang fai system, the main irrigation system of Chiangmai village, taking water from the Nọng Plaman weir at Ban Fai. The Huai Sai field, having in area 175.5 rai (28.08 ha) including a tiny compound (H2), is the southern extension of Huai Sai village's main field along the west bank of the river. It is watered by a system from the Huai Sai weir located further upstream. The Nọng Plaman field and the Huai Sai field represent the oldest and the major rice producing area of the village, of which reclamation was begun at the beginning of the nineteenth century when the pioneering peasants settled in the three hamlets of the village.

On the other hand, reclamation of the other two fields has mainly taken place in relatively recent times, since the 1930's. The Nahük field, with only 62.5 rai (10 ha) between Ban Fai and Ban Klang hamlets,



The thickness of the arrows is proportionate to the number of households needed to cultivate a plot within the field.

N1 and N2: Nong Plaman field irrigated by the Nong Plaman system
H1 and H2: Huai Sai field irrigated by the Huai Sai system
K : Nahük field irrigated by the Nahük system
M1 and M2: Mae Raem field irrigated by the Mae Raem system

Figure 16: Diagram of the Major Fields in Chiangmai Village

is the southern extension of an elongated field principally belonging to the three villages upstream. This portion of the Nahük field was substantially reclaimed in the 1930's, receiving irrigation water from a müang fai system constructed along the east bank of the Mae Rim from the Nahük weir at Pae Nahük village further upstream. The Mae Raem field, having an area of 102 rai (16.32 ha), is a part of Qi village's main field irrigated by the Mae Raem weir installed in a tributary channel of the Mae Raem river, which flows down from the western hills. The part of the Mae Raem field cultivated by Chiangmai villagers is divided into two compounds, both of which are located at the foot of the hills and form gently upward-sloping terrace plots. M1 compound was mainly reclaimed in the 1930's, while M2 compound is a result of quite recent reclamation in the 1950's. All these lands in the four major fields cultivated by the Chiangmai villagers, amounting to 689.75 rai (110.36 ha) in area, are almost exclusively devoted to main season cultivation of glutinous rice primarily for home consumption. In addition to this, a considerable number of households of rural labourers and of poor tenants living in the village have cleared the pae on the western hills to grow upland rice (khao hai) by shifting cultivation for their minimum subsistence. In contrast to the case of Ayutthaya village which we shall discuss later, rice cultivation, including upland rice cultivation, in the village shows a general orientation towards subsistence farming.

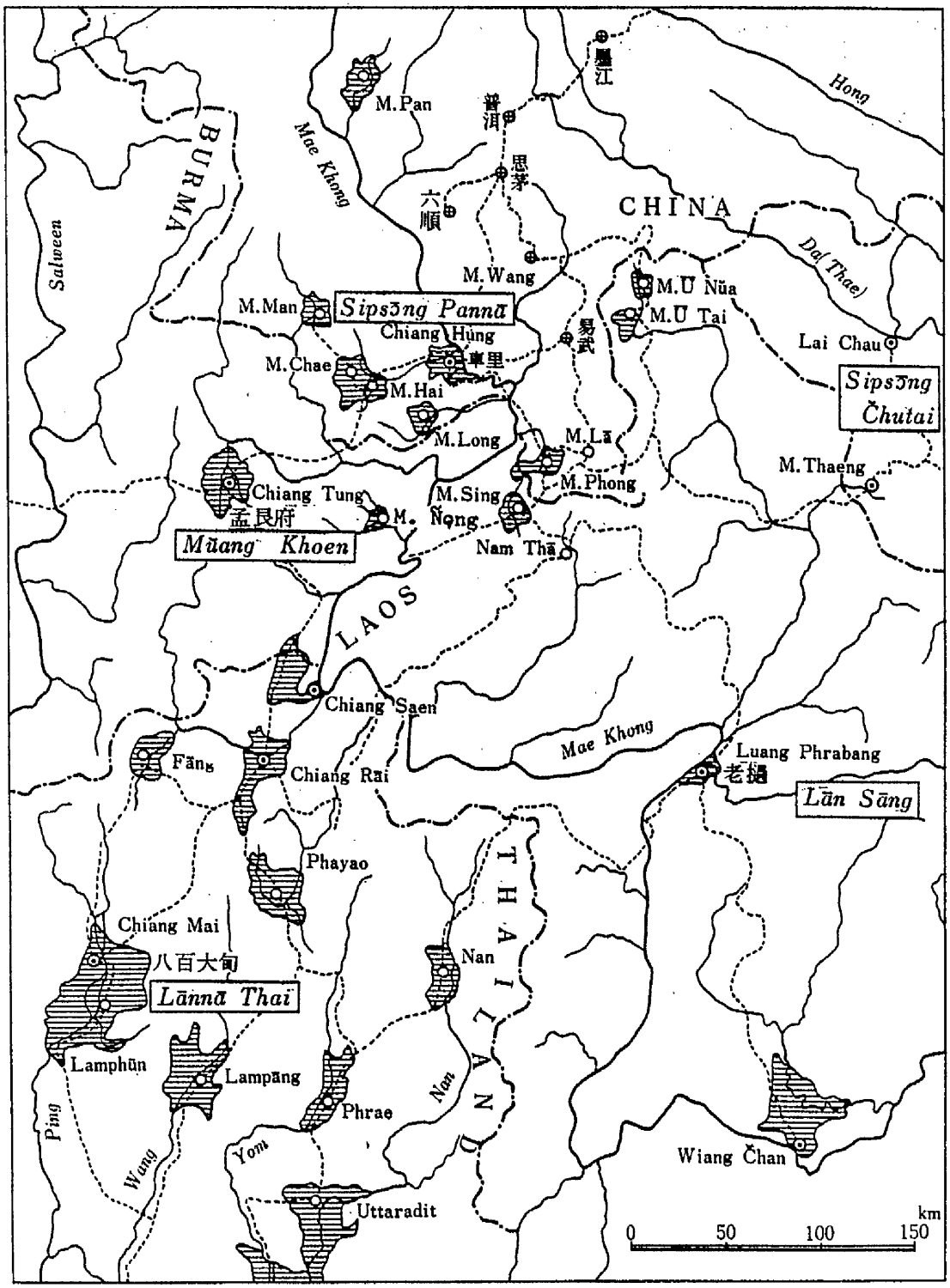
(2) People and Historical Background of the Village

Chiangmai village is mainly composed of Thai Lü, while Thai Yuan- sometimes called Khon Müang (people of müang), the main ethnic group of Lannathai region as well as in the Chiangmai basin - is predominant

in the other three villages of the Tambon and adjacent area along the Mae Rim valley. Although accurate figures are not available, more than sixty per cent of the population is believed to be Thai Lü.[5] Among the villagers up to the age of 50 years or thereabouts, standard Thai or Siamese are popularly intelligible as a consequence of the spread of primary education during the past few decades. However, the Chiangmai dialect of Lannathai (Thai Yuan) is basic and widely spoken in daily life. Lü, as their original language, which has slight differences of tonal structure from Lannathai, is still spoken especially by older generations and is apparently intelligible to younger generations who often have a command of polite standard Thai as well as Lannathai.[6] Among the villagers, however, the Lü language seems to have been predominant till the beginning of this century when the domain of Lannathai principalities were entirely annexed by the Siamese central government of Bangkok under its provincial administration. Some older informants who spent their childhood during the reign of Phrachao Inthawarorot, Prince of Chiangmai (ruled 1897-1909 A.D.) say that the villagers (about 110 households in that period) mainly spoke Lü throughout, and they did not feel disadvantaged because of the intelligibility between Lü and neighbouring Lannathai. As far as language is concerned, it seems likely that Chiangmai villagers have imperceptibly merged into the dominant Lannathai culture of Thai Yuan. With respect to social organisations in their socio-economic and religious life, we cannot detect any decided difference between the Thai Lü of Chiangmai village and their Thai Yuan neighbours. This is because the Lannathai culture centred in the Chiangmai basin has arisen as a result of the amalgamation of various Thai cultures which have been developed in their original homelands across the northern part of the Indochina

peninsula. Nevertheless, the formative process of Chiangmai village is closely related to the historical evidence of Thai Lü migration before the Siamese annexation early this century (Figure 17).

Among the villagers a stereotyped folktale claims that the early settlement of Thai Lü ancestors at the present village site began in the reign of Phrachao Boromarachathibodi, well-known as Phrachao Kawila (ruled 1781-1815 A.D.). This legend seems to be widely believed. King Kawila is the founder of the Kawila ruling family of Chiangmai, who achieved the restoration of Lannathai from Burmese control at the end of the eighteenth century. According to the folktale, it is commonly believed that the Thai Lü ancestors of the village came as war captives from Sipsong Panna in Yunnan and Müang Ñong in the Shan States, Burma. In these regions, King Kawila ordered assaults against the Burmese influence under the command of his viceroy, Phraya Uparatthamlanka after the restoration of sovereignty to northern Thailand at the beginning of the nineteenth century. The Thai Lü ancestors who originally lived in those areas were forced to move and camp temporarily outside the Chiangmai city wall. After that they seem to have been divided into many groups according to their old village or area and sent to Müang Phrao (present-day Amphoe Phrao), Müang Samoeng (present-day Amphoe Samoeng)[8] and Chiangmai village in Mae Rim, relatively close to the city and still sparsely populated. This is the story of their pioneer migration which is consistent among the older villagers; however, it is sometimes said that the viceroy's expedition took place in the latter years of the reign of Chao Chiwit Ao (Phrachao Kawilorot, ruled 1856-1869 A.D.), the sixth reign of the Kawila dynasty in the mid-nineteenth century.



: River channel
: National boundary
: Road
: Riceland
: Town
: Chinese commercial base
: Capital of kingdoms and principalities

Figure 17: Thai Kingdoms and Principalities in the Upper Maekhong River

At any rate, the story of the migration from the Sipsǫng Panna area corresponds with the historical evidence of the prolonged and large scale conflict between Siam and Burma which commenced after the Burmese capture of Ayutthaya, the capital of the Siamese Kingdom in 1767. The principalities of Lannathai in the northern intermontane basins, which were traditionally a buffer zone between the two powerful states, were successively involved in the war for long periods. Kawila, the heir apparent of the Prince of Lampang, launched a counter-attack against Burmese sovereignty over the Lannathai region, closely allied to Taksin of Thonburi and later Čhaophraya Čhakri of Bangkok as the sole suzerainty (Prachakitkǫnračhak, 1964: 453-470). After more than 30 years of repeated efforts to overthrow the Burmese forces, the main policy for restoration was focused on securing a labour force (which had been reduced in war time) for the cultivation of ricelands in the regained territory. The traditional rulers seem to have made it their first aim to gather together a sufficiently large number of peasants to till the vast and uncultivated occupied territories. This is because traditional rulers in the intermontane basins as well as the southern powerful kingdoms had been suffering perpetually from a shortage of manpower, despite the existence of a comparatively large uncultivated wilderness until the mid-nineteenth century. Thus the reason for wars in that period seems to have been closely related to an exchange of manpower on a large scale, which necessarily led to scrambling for captives to be settled in each territory. The traditional war policy of securing production through resettlement of captives in Lannathai is proverbially summed up: put vegetables into baskets, people into müang (kep phak sai sa kep kha sai müang) (Sanguan, 1965: 290; Kraisi, 1965c:6-9).

In L.E. 1166 (1804 A.D.), and following the anti-Burmese war, the viceroy, Phraya Uparat, was ordered by Kawila to command the military expeditions to attack the remaining Burmese bases in the Chiangsaen area. In L.E. 1166-1167, Phraya Uparat subsequently attacked Müang Ñǫng and a part of Sipsǫng Panna situated on the west bank of the Maekhong river on the border area between China and Burma (Khana Kammakan chatphim Ekasan, 1971: 114-117; Prachakitkǫnračhak, 1964: 468-473). These successful military expenditions not only helped to establish Lannathai's decisive sovereignty over those regions but also provided a large number of captives to be settled as rural cultivators for the restoration of the devastated countryside.[9] The sources say that Kawila asked the suzerain, King Rama I of Bangkok (Čhaophraya Čhakri) for control of those captives and settled them in various areas according to their original dwellings (Sanguan, 1965: 301-302; Sanguan 1969: 196-197).[10] The folktale referring to pioneer settlement of Thai Lü in the village very likely alludes to the historical events of those military expeditions and their results in the beginning of the nineteenth century. Thus it may be suggested that the pioneer settlement of the village was a result of the traditional organisation of manpower requirements just after the restoration of Lannathai in the beginning of the nineteenth century, although only fragments of folktales are available to bear this out.

In the pioneering days of the village the three Thai Lü hamlets were founded between the existing Thai Yuan villages of Huai Sai and Qi along the Mae Rim valley. Significant socio-political changes were brought about at the beginning of this century by the introduction of a centralised provincial administration system by the central government of Bangkok.[11] The lower level of administration was improved under

nai amphoe, a district officer appointed by the central government when the Mae Rim district office was erected at the present site in 1916 (Mae Rim, 1975: 1-2). In order to maintain public order and secure tax revenue in rural areas po khwaen, formerly called čhao khwaen responsible for Tambon, and po luang for the village respectively, were established under the supervision of nai amphoe who were mainly selected from the nobility of the old aristocracy. In the next year Phra Thawiprasat, a noble of Chiangmai who had pursued his studies at the School of the Royal Page (rongrian mahatlek luang) in Bangkok, proceeded to nai amphoe of Mae Rim district. Most po khwaens, who rose to have full power to collect taxes and to secure social order during Phra Thawiprasat's office, exercised power over the villagers' social life also (Prani, 1963: Vol.2,186-191).

In this transitional period, Inta Siduangkaeo (ca. 1890-1943 A.D.) later known as Khun Saisarakit, who was born in Tambon San Pong, a Thai Yuan village along the Chiangmai-Fang highway, appeared in Chiangmai village. Inta with his father had built up trade, especially dealing in teak and other miscellaneous timbers, from the highway up to Tambon Saluang, upstream of the Mae Rim valley. Their ox-cart caravans used to stop over in Chiangmai village, where they pastured cattle in pae stretching to the east. He married a girl from the village and settled there to operate a farm around 1914. A few years later, he became one of the richest landowners by purchasing rice fields in the village amounting to more than 30 rai and was appointed as po khwaen controlling the seven villages in 1918. It is widely said that Khun Saisarakit performed his duties rigorously in the collection of taxes such as poll-tax and an education fee (kha bamrung kansüksa), and especially in order to preserve public order he always wielded his police power with his two followers in search of thieves and in exercising control

over gambling.[12] Thus, it seems that the centralised provincial administration carried out by the Ministry of Interior in Bangkok was being executed even in remote areas such as Chiangmai village.

At the same time, economic change, especially relating to land tenure also began to come about from the beginning of this century. At the turn of the century during the period of Phraya Uttama, who was pǫ khwaen until around 1910, most peasants had about ten rai of their own riceland per household on average, and fairly large amounts of wastelands still remained to be claimed for cultivation. Although large scale landownership had hardly been seen in the village and in adjacent areas, there was, however, one exception; Phraya Uttama held about 90 rai of ricelands cultivated by many regularly hired labourers or luk čhang. Coming to the period of Khun Saisarakit in the 1920's, however, the possibilities of claiming wilderness for cultivation (čhap čhǫng) became restricted in the two main fields, because these fields had been mostly cleared already and their ownership established by this period. Because of the shortage of land, land renting among relatives, in particular parents renting a part of their land to their married children, seems to have become popular, while in many cases the filial family expected to inherit a parent's holdings after their retirement from farming or death. In this period, Khun Saisarakit who had accumulated about 70 rai of paddy plots mainly located in the centre of the Nǫng Plaman field, at first operated the full area depending on several luk čhang, mobilising a number of peasants as temporary labour. A few years later, in the 1930's, 20 rai of the total owned land was cultivated by five luk čhang, while the rest was rented out to other villagers. In addition to renting among relatives, tenancy among non-relatives prevailed widely in the village and petty landlord-

operators who cultivated their own land also emerged in this period, while at the same time providing small areas to tenants.

Despite the increasing tendency towards tenancy, villagers' efforts to clear the wilderness and ǰhap ǰhọng were also proceeding into the marginal area which seems to have been previously covered by monsoon forests in the 1930's. Adding to the existing two main fields opened since the pioneering period in the early nineteenth century, the remarkable development of ǰhap ǰhọng on the fringes of arable land in this period obviously marked the close of favourable development of rice cultivation through expansion of the cultivated area. After this there seems to have been no expansion of riceland on a large scale, despite some small reclamations in the Mae Raem field (M2) during the 1950's, and the clearing of pae using slash-burn method, which continued until recent times. Peasants' land-holdings have been increasingly subdivided into fragments by inheritance over several generations. Even in the case of Khun Saisarakit's lands which were roughly estimated to have been about 100 rai at his death in 1943, they were divided into several plots and inherited by his progeny. The fragmentation of landholding and population growth have provided small scale but complicated landlord-tenant relationships as well as renting among relatives of the limited amount of land. In addition to an increase in tenancy, there is a growing tendency for a number of landless rural labourers or khon hap ǰhang to stay within the village at the present day.

3. Ayutthaya Village in the Chao Phraya Delta

(1) Ayutthaya Village

People who travel northwards along the Route No. 1 or Super Highway from Bangkok notice a slight topographical change shortly

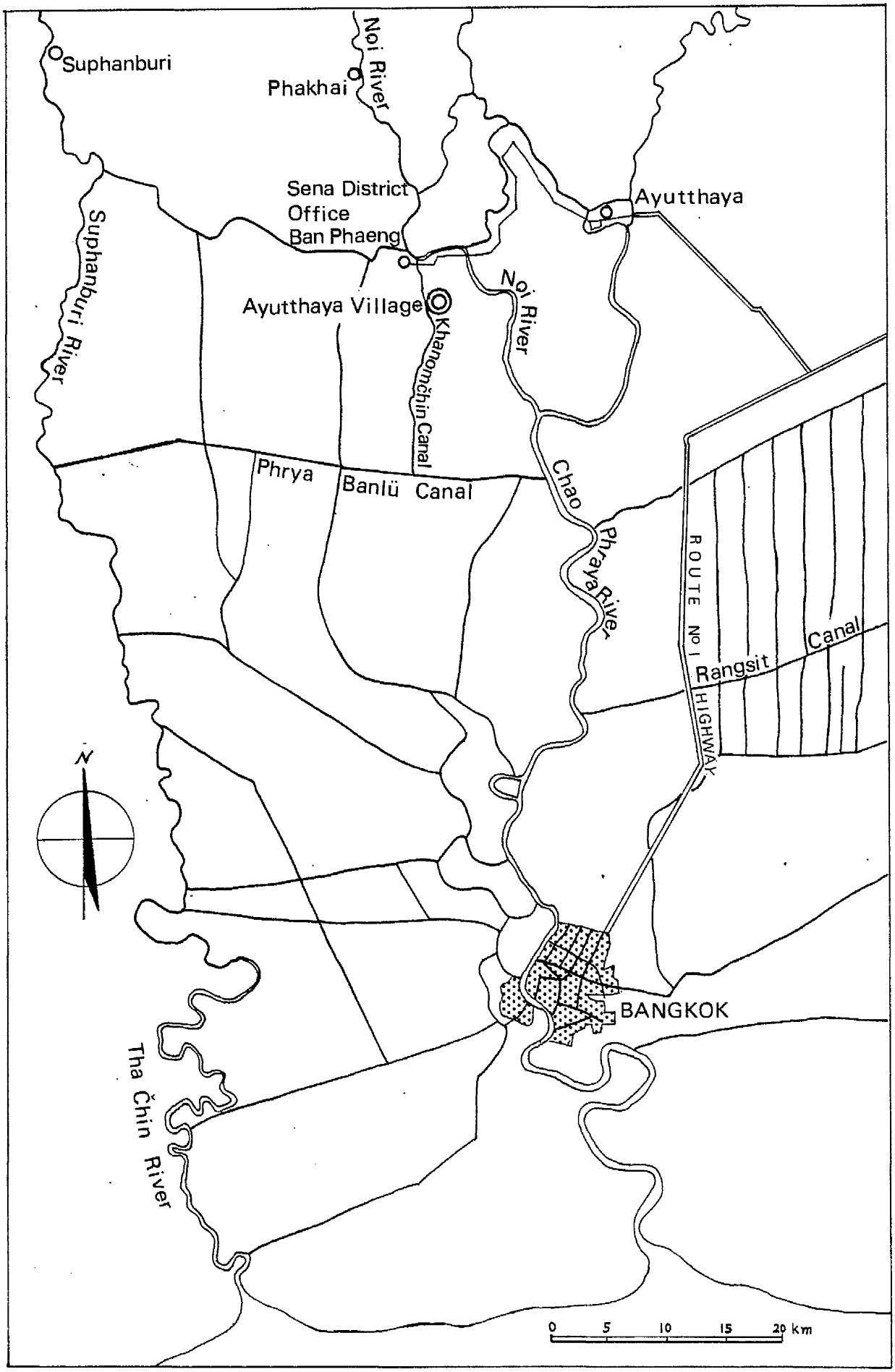


Figure 18: Map Showing the Route from Bangkok to Ayutthaya Village

after passing the Dɒng Müang Airport. The change becomes more obvious when Route No.1 crosses the bridge over the Rangsit canal, for this canal is a relief feature of the remarkable development of reclamation in the Chao Phraya delta region. The low-lying flat terrain, almost devoid of local relief and entirely covered with emerald green rice, gradually lowers and stretches away as far as the eye can see. The highway runs through this flat delta area which extends along the east bank of the Chao Phraya main channel from the Rangsit canal system as far as around the Lopburi river. Going a little further on, a lateral highway branches off from Route No.1 to the west and, crossing over the Pasak river, comes to Ayutthaya, a typical provincial city of central Thailand, with the city hall in its centre. Beyond the city area, which is surrounded by rivers and canals, a vast flat area subject to long and deep flooding in the rainy season extends from the bank of the Chao Phraya to the Suphanburi river to the west, and from the Phraya Banlü canal linking the Chao Phraya with the Suphanburi river, to the Phakhai region along the Nɒi river to the north. This area of deep flooding together with the eastern part which stretches from Ayutthaya to around the Lopburi river on the east bank corresponds to the Retarding Basin, a subdivision of the Delta type of farming region.

From the west end of the city area of Ayutthaya a rugged road goes to the Nɒi river along the newly excavated Bang Ban project canal. Vehicles have to cross the Nɒi river by the ferry boat at Sikuk where Burmese troops erected a fort called Khai Sikuk to capture the capital just before its final surrender in 1767. Crossing the Nɒi after a long wait for the ferry, the traffic runs along the Nɒi and can reach Tambon Ban Phaen, where the district office of Amphoe Sena

is located, 26 km from the City Hall of Ayutthaya. Ban Phaen, whose only road connection is with Ayutthaya, is essentially a centre of water transport, being situated at a junction of the Nǫi and the Čhao Čhet Bang Yihon canal linking the Suphanburi river with the Nǫi. A huge number of cargo boats (rüa krachaeng; rüa tǫ) fully laden with unhusked rice sail down the Čhao Čhet Bang Yihon canal from the Suphanburi region and often stop over at a row of rice mills along the canal at Ban Phaen for purposes of selling or trans-shipment.[13] Also, rice cargoes are brought down from the Phakhai region along the Nǫi river. Most of these cargoes are sold to rice mills at Ban Phaen directly and are later transported to Bangkok by larger boats via the Nǫi and the Chao Phraya main channel.[14]

Thus owing to ease of water transport via the Nǫi and Chao Phraya rivers, the district of Amphoe Sena (of which Ban Phaen is the centre) seems to be connected more directly with Bangkok[15] than with the nearby provincial city of Ayutthaya. For a very long period, reliance on water transport was a salient feature of life in Ban Phaen and adjacent areas. In recent years, however, this dependence has been weakened by the construction of a road linking Ban Phaen with Ayutthaya.[16]

Approximately 1 km to the south of Ban Phaen lies the Khanomčhin canal. This canal is equipped with head regulators and pumps, and is linked to the Nǫi channel. Most water channels of this district are now artificially controlled, including the Khanomčhin canal. Until the early 1960's, however, they constituted a natural drainage pattern which drained northwards or northeastwards into the Nǫi river.[17] The Khanomčhin canalwas not originally artificial but formed part of a natural tributary of the Nǫi about 7 km in length flowing down from Amphoe Lat Bualuang in the south (Ratchabanditsathan, 1941: 16). After

improvement as an irrigation-drainage canal by the government in the 1960's, it was extended to the Phraya Banlü canal and functions, to a certain extent, as a means of water supply and drainage for the adjacent rice fields (Figures 19 and 20).

Within ten minutes of travel along the Khanomchin canal by motor boat from the junction of the canal and the Nọi, one encounters a linear village, situated on the east bank, which affords splendid views of floating rice fields. This is Ton Tan village (Village No.9), called hereafter Ayutthaya village, of Tambon Bang Nomkho, an administrative unit which consists of ten villages along the canal and the Nọi channel. Tambon Bang Nomkho contains 573 households and a population of 3,538. In 1975, Ayutthaya village was the largest of the ten villages, with 83 households and a population of 378. The area of the Tambon extends from the canal to the Rang Khok, a narrow and crooked drainage water course in the depression, and bordered by the Nọi to the north and the Chang Lek canal to the south.

From the historical point of view, Ayutthaya village did not originally function as a traffic centre and did not benefit from trade which flourished in Ban Phaen area along the Nọi channel. However, because of the development of water traffic in the canal accompanied by the recent improvement in irrigation works, it has become a small trading place with some retail shops and grocers serving the boats passing along the canal. Moreover in 1973, the opening of a road from the main road to Tambon Sam Tum which ran parallel to the canal greatly facilitated traffic from the outer areas. The importance of the village has been further enhanced by the appointment of one of the residents to the post of kamnan or head of the Tambon. Since this resident has held office for more than ten years, Ayutthaya village has come to be widely

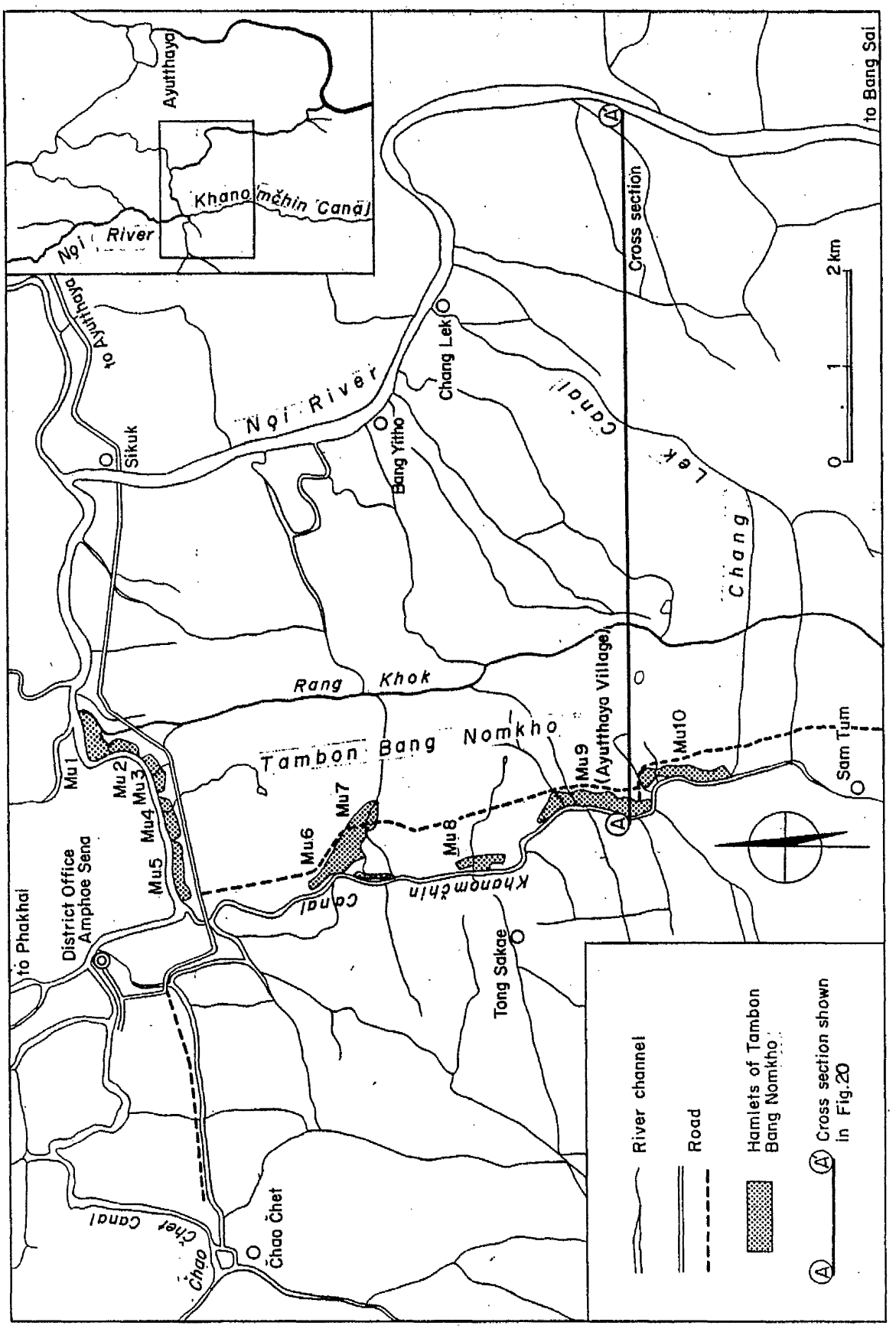


Figure 19: Ayutthaya Village in the Khanomchin Canal Area

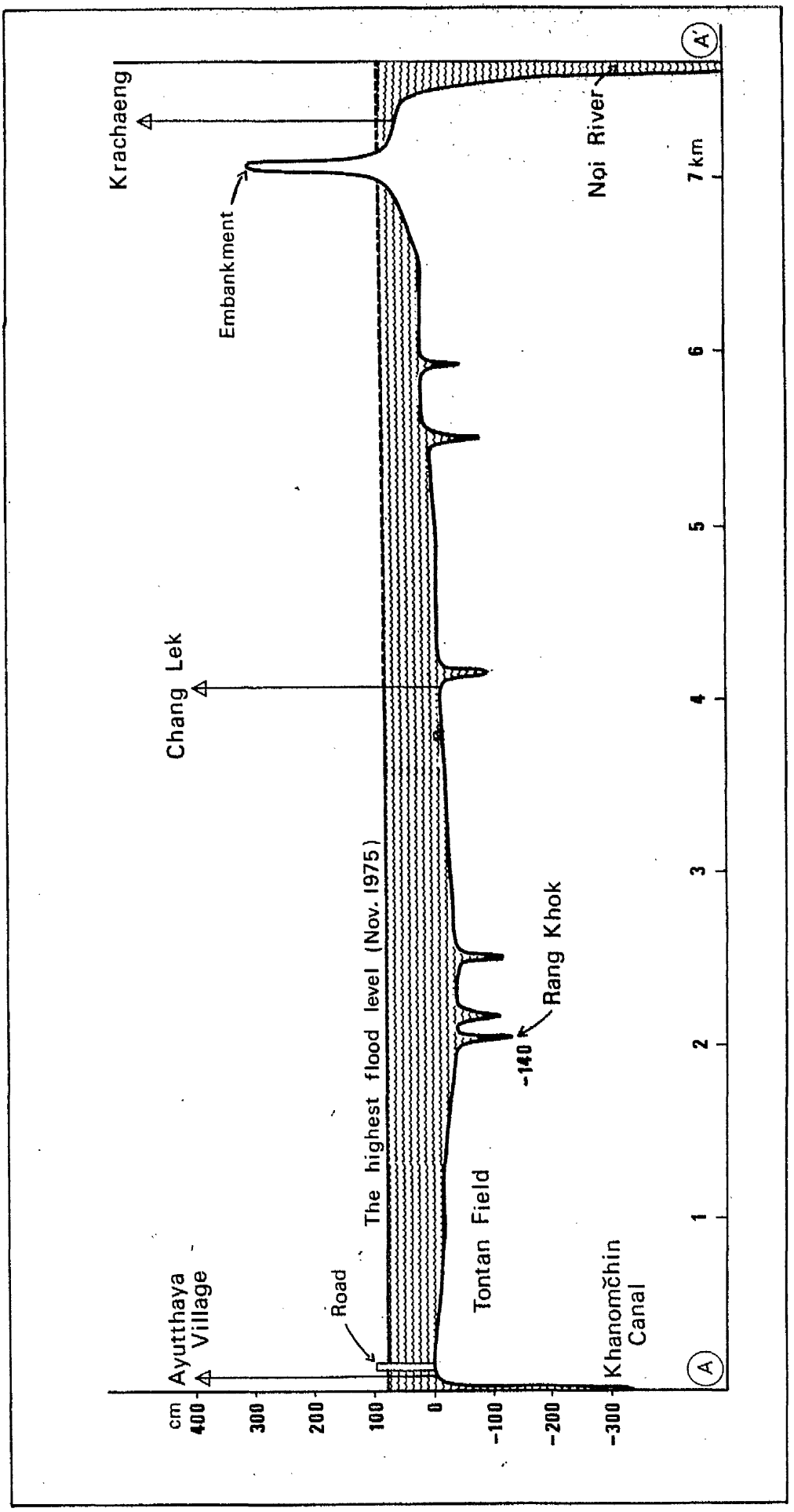


Figure 20: Profile of the Cross Section A - A' (Figure 19)

regarded as the administrative centre of the Tambon, or in other words, ban kamnan, the village of the kamnan. The Tambon Council or sapha tambon and other meetings which give decisions on important matters relevant to villagers of the Tambon, are usually held at the compound of Wat Manwichai, the Buddhist monastery situated at the centre of the village. Thus in recent years, Ayutthaya village has come to perform important functions in local administration and water traffic (Figure 21).

In Ayutthaya village, as in the case of Chiangmai village, the wat provides the centre of social and religious life of every villager. For all villagers, activities in merit-making (tham bun) and participation in the Buddhist rituals and ceremonies held at Wat Manwichai represent one of the most significant aspects of their way of life. However, the wat, though located in Ayutthaya village, does not belong solely to the village and its villagers, but finds more believers among the peasants from the adjacent villages such as Ko Klang (Village No.10 of the same tambon) immediately to the south, and some villagers on the opposite bank of the Khanomchin canal which belong to Tambon Manwichai. The wat committee which is an organisation of laymen to support the wat management, is therefore organised among the peasants in these villages. Likewise, the other two wat located in Tambon Bang Nomkho also have peasant laymen and their committee members from other villages on the opposite bank of their own villages. Those facts mean that the area of Buddhist laymen's committee does not necessarily correspond to the area of a village community as an administrative unit, and is often broader than the latter. Such discrepancy between the two areas is commonly observed throughout the delta region, where linear settlement is predominantly developed along water courses and canals which tend to

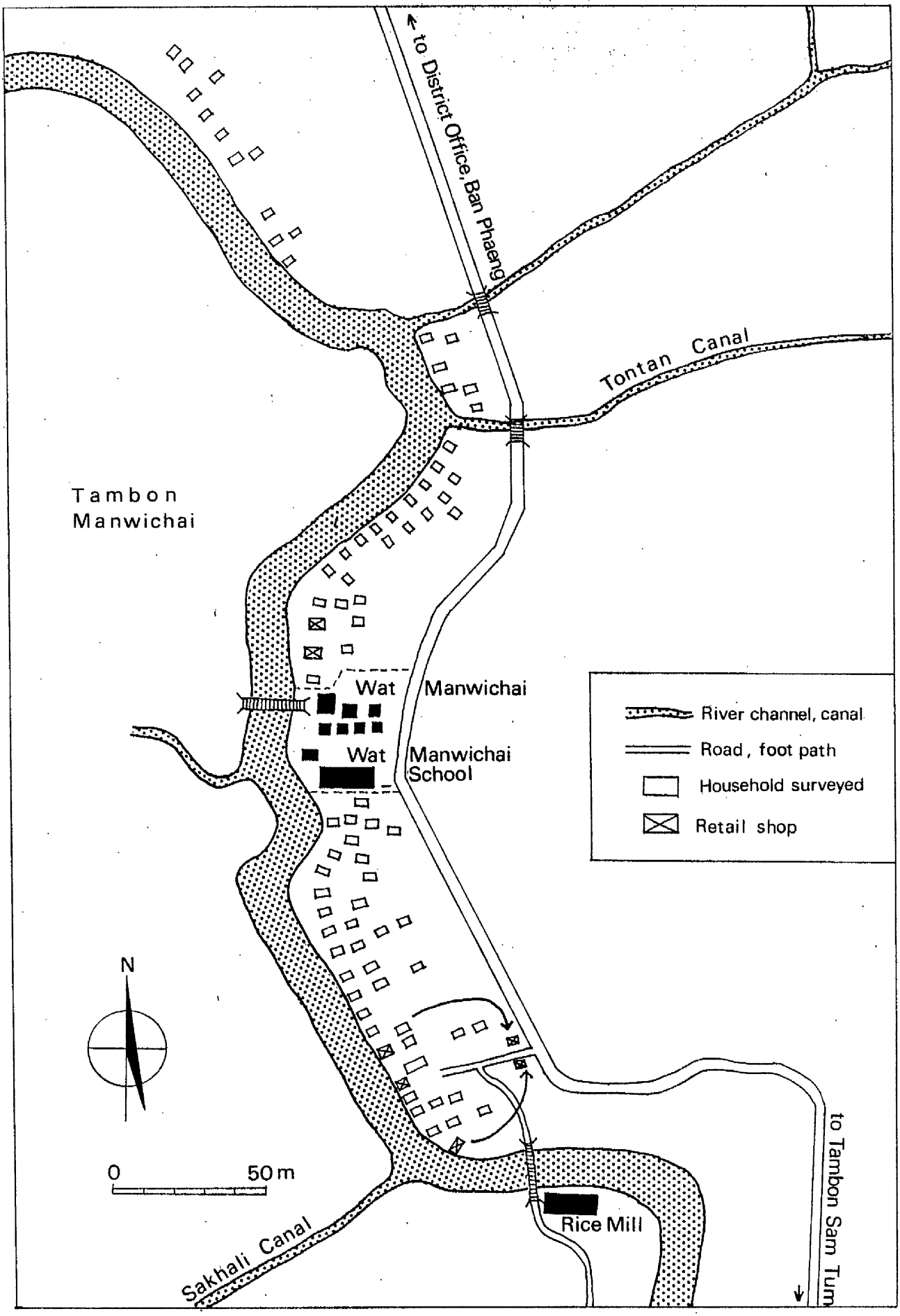


Figure 21: Settlement Plan of Ayutthaya Village

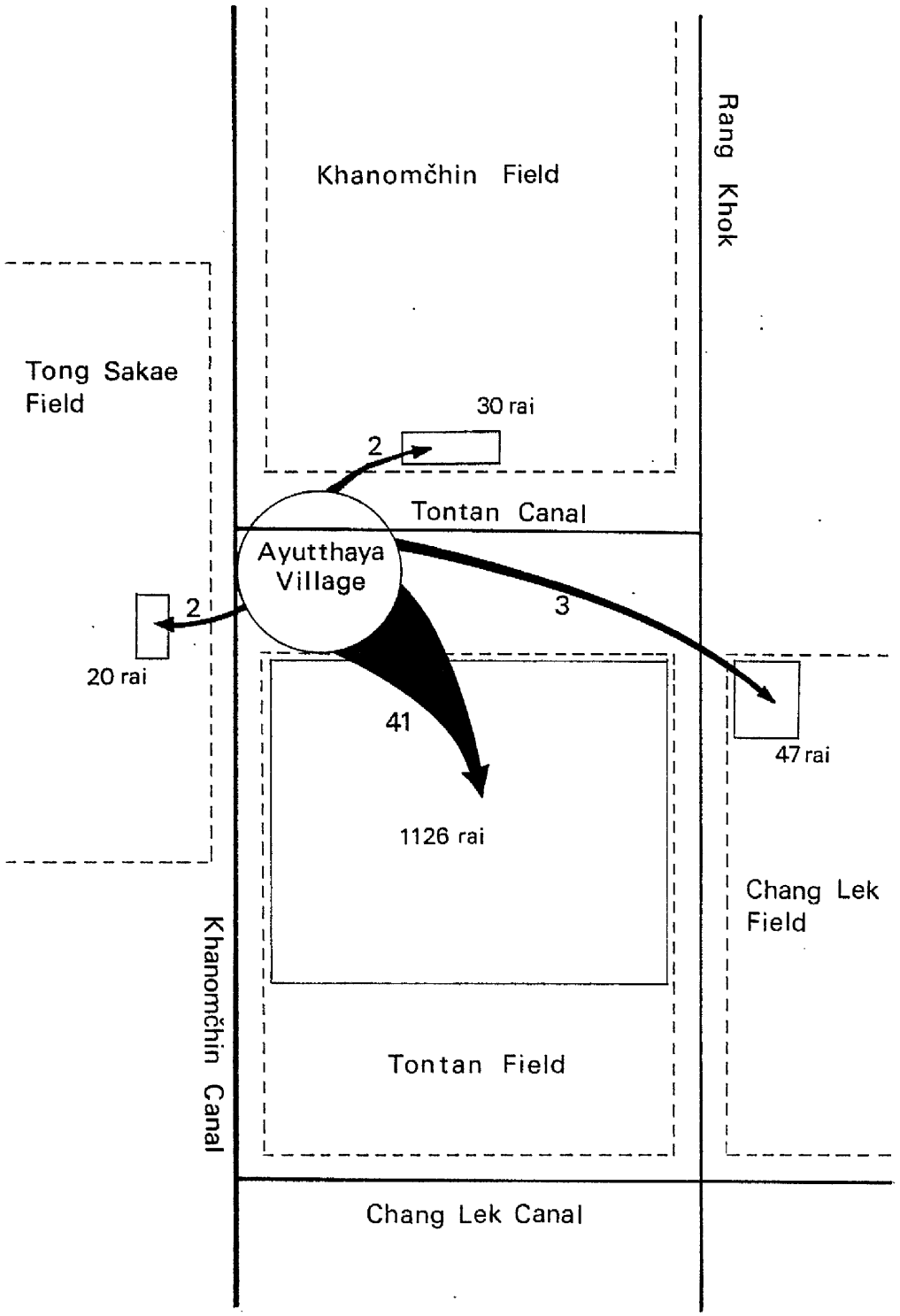
demarcate boundaries of administrative units. This discrepancy seems to be partially a result of the establishment of local administrative units since the turn of the century, which was carried out with little thought of the existing framework of the spontaneously developed communities. At any rate, it seems to provide to Ayutthaya village a less clear framework of community than that observed in Chiangmai village, where the Buddhist laymen's community precisely corresponds to the administrative unit of the village.

In addition to this, there are fewer social and religious factors which serve to enhance the integrity of the village community in Ayutthaya village. In the village we can find hardly any traditional collective rituals or traces to prove their existence in the past, which would indicate the formation of neighbourhood groups with the common interests of those living in a given locality. Contrasting to Chiangmai village, Ayutthaya village lacks a guardian spirit of the hamlet or village to symbolise its land and people. Instead, there are some households who erect and worship san phraphum čhaothi (a shrine of the land spirit)[18] in their own compound, which is principally of a guardian spirit protecting individual land assets and households. The worship of san phraphum čhaothi which is of widespread prevalence in the delta region is essentially individual, and shows a sharp contrast to the spirit cult of phi ban practised in Chiangmai village.

With respect to the process of rice production, it is particularly worth noting that Ayutthaya's villagers have never developed any social organisation for effective control of an irrigated environment, their agriculture depending basically upon natural precipitation and inundation. This has a significant effect upon technology throughout the whole farming operation, and provides for an individualism in rice

cultivation which presents a great contrast to the highly co-operative farming in Chiangmai village. The individualistic nature of Ayutthaya's farming is also recently strengthened by the fact that traditional labour exchange groups (mu ao raeng) have almost completely disappeared and have been replaced by wage labour in most operating households regardless of wealth. The recent disappearance of labour exchange in the village seems to be a direct result of the rapid penetration of the money economy in the production process and of increasing supplies of wage labour both within and outside the village. Moreover, the weakness of the co-operative social norm in the production process appears to be responsible for the rapid decline of labour exchange arrangements during the past few decades. Taking all these brief observations of social aspects of peasant life into consideration, it can be safely said that Ayutthaya village lacks indigenously developed co-operative organisations in the production process and is less integrated as a village community when compared with Chiangmai village in the intermontane basin.[19]

Most ricelands operated by Ayutthaya villagers are located on the east bank of the Khanomchin canal, stretching from the bank to the Rang Khok channel to the east, with their northern limit an east-west line crossing the site of Village No.8 and their southern limit the Chang Lek canal near Village No.10 (Figures 19 and 22). This low-lying land is customarily called the Tontan field (Thung Tontan), in which 1,126 rai (180.16 ha) or 92 per cent of the total operated area(1,223 rai) are located. The remaining areas of 97 rai are in the Khanomchin field (30 rai), north of the Tontan field, in the Chang Lek field (47 rai) on the opposite bank of the Rang Khok channel and in the Tong Sakae field (20 rai) on the opposite bank of the Khanomchin canal. As



The thickness of the arrows is proportionate to the number of households needed to cultivate a plot within the field.

Figure 22: Diagram of the Major Fields in Ayutthaya Village

we shall discuss later, the beginnings of substantial reclamation of the Tontan field and adjacent fields is of relatively recent origin, dating mainly from around the turn of the century.

In contrast to the fields in Chiangmai village, these fields are subject to deep annual flooding. The villagers have mostly adopted the broadcast-sowing method for the main season cultivation and have made a suitable choice of late varieties of non-glutinous rice including the so-called 'floating rice' (khao khün nam) adapted to the long season of deep flooding. The annual flooding of the canal usually begins in late August. Owing to the continuous heavy rainfall in the following months, flood water overflows the relatively low natural levees on which settlements are found, into the fields, and the highest floods can raise the water level to over 1.5 m above ground level (Figure 20). The inundation continues until early December and gradually subsides by harvesting time from mid-December to January. Ayutthaya's rice farming has long been based on this gigantic inundation, a water source outside the villagers' control, as well as on the uncertainty of rainfall. As we shall see later, rice production in these fields has become basically oriented towards the market as well as to fulfilling the villagers' own consumption needs. In contrast to Chiangmai village, the rice farming in Ayutthaya village, has long been deeply involved in rice marketing for export, as it is assured of convenient water transport like many villages in the delta region.

(2) People and Historical Background of the Village

The ethnic composition of the village is homogeneous. Throughout its history, it seems to have been entirely composed of Thai who speak the central Thai dialect (standard Thai or Siamese). The same is true

of adjacent villages along the Khanomčhin canal area. Although people of Chinese descent, who mostly carry on busy trade in rice mills and other retail establishments, are widely found in Ban Phaen and Čhao Čhet, they are rarely encountered along the Khanomčhin canal. According to some old villagers who are able to recall their youth in the reign of King Rama VI (1910-1925 A.D.), the people of their father's generation moved to the present site in order to obtain riceland from areas immediately to the north such as Village No.6, No.7, No.8 or from the Ban Phaen and Čhao Čhet areas. These pioneering ancestors must have settled and cleared what was then largely a wilderness in the depressions along the canal towards the south. In order to add clarity to the development of rice cultivation and the peasants' life, some historical examination is appropriate here.

The pioneering settlement at the site of Ayutthaya village is believed to have commenced in earnest with clearing along the Khanomčhin canal at the close of the nineteenth century. In the latter half of the nineteenth century, the area from the mouth of the Khanomčhin canal up to Ayutthaya village, was very sparsely populated. According to the folktales of older villagers, Wat Manwichai, today situated at the centre of the village, was in that period surrounded by monsoon forest of ton sakae (Combretum) in which there existed three small hamlets, all situated along the canal. On the other hand, Čhao Čhet and Ban Phaen, being located on the main water transport route to Ayutthaya and Bangkok, flourished as trading settlements. But the depressions along the canal which had fallen into a wilderness of malaria-carrying mosquitoes and wild animals did not attract cultivators.

Rice cultivation and peasant settlement in the regions surrounding the old capital of Ayutthaya, and in particular, along the Noi channel,

seem to have been developed in a rather later period than would generally be expected. The deep flooding Retarding Basin along the Nǫi river was almost certainly governed directly by the capital as nǫk phranakhǫn or the outer region of the capital,[20] during the greater part of the Ayutthaya period (1350-1767 A.D.). The district then known as Khwaeng Khun Sena, the district governed by an official called Khun Sena, one of the four districts of nǫk phranakhǫn, must have covered at least the present Amphoe Sena, Amphoe Phakhai, Amphoe Bang Ban and Amphoe Bang Sai west of the capital. Although Khwaeng Khun Sena was not so important in agricultural production, it seems to have occupied a crucial area for defence of the capital against Burmese attack from the west throughout the Ayutthaya period. Therefore, Burmese troops had to erect Khai Sikuk near Ayutthaya village as a base for capturing the Siamese capital. After the fall of Ayutthaya in 1767, the former capital and its nǫk phranakhǫn were significantly reduced in administrative importance. Ayutthaya became a province named Krung Kao (old city) under the rule of a governor, phu raksa krung, sent from the new capital of Bangkok during the early Ratanakosin period. In the reign of Rama III (1824-1851 A.D.), Sena was divided into two districts : Sena Yai in the north, corresponding to the present Amphoe Phakhai, Amphoe Sena and a part of Amphoe Bang Ban, and Sena Nǫi in the south as far as the present Amphoe Bang Sai and a part of Amphoe Bang Sen (Boranratchathanin, 1959: 101-103). According to a source dated 1843, construction works were carried out to shut canal sluices in order to protect the rice fields from incipient flooding in the areas close to the Khanomčhin canal in Sena (Krom Sinlapakǫn, 1969: 17-18). This indicates that to a certain extent rice cultivation and rural settlement was already developed in this area by the mid-nineteenth century.

Since the 1880's, large scale reclamation of ricelands accomplished by canal excavation have achieved a remarkable development in the lower part of the delta (Tanabe, 1978a: 58-67). However, rapid expansion of ricelands towards the deep flooding area began somewhat later, around the turn of the century (Johnston, 1976 : 38; Tanabe, 1978a: 73). On his inspection of this region in R.E. 117 (1898 A.D.), Prince Damrong the then Minister of the Interior, recorded that rice fields were well adapted to the deep water and public order was maintained in the Phakhai region (Damrong, 1972: 2-4). Some ten years later, King Rama V, on his royal trip in R.E. 127 (1908 A.D.), recorded his astonishment at the rapid development of peasant settlements along the Nǫi and even said that Phakhai had attained greater prosperity than Suphanburi, which was a famous centre of rice-growing along the Suphanburi river (Chulalongkorn, 1950: 26, 30). In addition to reclamation, the setting-up of district offices was proceeding apace in line with the development of provincial administration under the Ministry of the Interior. In R.E. 122 (1903/4 A.D.), the former Sena Yai and Sena Nǫi were divided into four districts, and the present area of Amphoe Sena succeeded one of them, then called Amphoe Sena Klang (Boranratchathanin, 1959: 104-105). The district office of Amphoe Sena Klang which was firstly established near Tambon Čhao Čhet moved to the Nǫi and the Čhao Čhet Bang Yihon canal junction at Ban Phaen for traffic convenience in 1910 (Boranratchathanin, 1961: 11). It is said that within a few years after the establishment of the new office, a number of rafts (phae) and rice cargo boats crowded into the channel around the office, where a large marketplace adjoining Phakhai came into being.[21] Phraya Boranratchathanin, a High Commissioner to Monthon Krung Kao who first assumed office in Ayutthaya in R.E. 119 (1900/1 A.D.), described the

rapid growth of rice cultivation of this area in 1916 as follows:

> "When I first came to government service in Krung Kao, some ten thousands rai of wilderness covered the area of this Amphoe [Amphoe Sena Klang], and rice fields stretched only a short distance from farm houses. But today, the wilderness has disappeared and changed into rice fields as far as the border of Suphanburi province." (Boranratchathanin, 1961: 12).

Ayutthaya village was apparently formed during such rapid reclamation around the turn of the century. There is very little doubt that the peasants cleared the wilderness with the aim of cultivating crops for petty commodity production, in response to the steady growth of export agriculture which occurred after the end of the nineteenth century. However, certain particular circumstances also affected the land reclamation of the village and adjacent areas along the canal. According to some older informants, the lands along the canal, which were first cultivated by their ancestors, were divided into two categories according to land tenure. The first is called na sapsin suan phramahakasat (riceland of crown property) or simply na luang (royal riceland) which was mainly located north of the village along the Rang Khok. This type of riceland was not only to be found in Ayutthaya village but also more extensively in the northern part of Tambon Bang Nomkho to the north, in Tambon Bang Yitho and Tambon Chang Lek of Amphoe Bang Sai to the east and also to the west of Khanomčhin canal as far as the San canal. The na luang had been under the ownership of the King, and therefore the peasants who cleared and cultivated it became tenants who had to pay a farm rent to the Department of Crown Lands, then called krom phrakhlang khangthi (K.S. 3.3/26).

The alternative type of holding was ordinary land where pioneer peasants could clear and claim (čhap čhong) their ownership. This type of riceland is sometimes called na ratsadon (people's riceland) in contrast to na luang, but in many cases such reclamation was undertaken by wealthy noble officials as a private business enterprise, simultaneous with that undertaken by peasants. It may be said that initial reclamation of the na luang then stimulated the reclamation of na ratsadon. The na luang, as crown property, continued to exist at least until 1975 when this research was carried out.

Some accounts concerning the formative process of na luang in the village are given in historical documents of the Ministry of Agriculture (krasuang kasettrathikan) in the reign of King Rama V. In R.E. 109 (1890/1 A.D.) Phraya Phatsakonrawong, then the Minister of Agriculture, proposed that the King should take possession of vast tracts of wilderness in Tambon Sakae and Tambon Khanomčhin as na luang for the Crown Prince Wachirawut (who became Rama VI in 1910) (K.S. 3.3/2). This proposal was advanced in order to secure government revenue from kha na or riceland tax by keeping land reclamation under direct government control against a growing proliferation of disorganised private enterprises in the delta since the 1880's. At the same time, Phatsakonrawong apparently intended to establish royal estates on a huge scale to collect farm rents from those who came to cultivate them (Tanabe, 1978d: 78-82). A letter dated in 1890 from Phatsakonrawong to the throne describes the proposed areas to be opened as follows:

> "According to the inspection by Phraya Kasetraksa [an official of the Ministry of Agriculture] and Phraya Chaiwichit, the governor of Krung Kao, the land left uncultivated in two Tambon, i.e. Ban Sakae and Ban Khanomčhin seems to be suitable for rice cultivation. People do not use this area so

> much, because of inadequate supplies of water and the absence of a transport route. In the case of Ban Sakae, inundation occurs so quickly before ripening that rice growers cannot get a good yield. Therefore, the construction of a barrage to prevent inundation will be required. For Tambon Khanomčhin, it is essential to secure transport routes by dredging the existing canals and water courses to make convenient use of boat traffic. Thus both areas will be filled with floating rice fields (na fang khün)." (K.S. 3.3/2).

The area here mentioned as Ban Khanomčhin seems to cover both banks of the canal including the present Ayutthaya village, then less populated, with the old Khanomčhin Nai village as its centre, now known as Villages No.6 and No.7. For reclamation of wastelands along the canal, improvement of water transport facilities was a prerequisite. Phatsakǫnrawong writes in the same year as follows:

> "Because of absence of water in the dry season, there is difficulty in the provision of the necessary water transport. Therefore, people cannot come to settle and earn a living there. But the area is fertile and actually of much benefit to cultivation. In Ban Khanomchin there are a lot of distributaries from old channels. Because some parts of those channels are shallow and narrow, we would like to excavate them to improve communications both in the dry and rainy seasons. If this can be done, there will be benefit to the state because remarkable expansion of riceland can be expected." (K.S. 9.2/2).

In addition to the proposal by the officials, a member of the royal family, Čhaomün Sanphetphakdi, who had a certain amount of land rented out to peasants in this area, was also applying for canal excavation similar to the above project. However, his application was bitterly opposed by the Ministry of Agriculture for the following reasons (K.S. 9.2/2). Firstly because many disputes had arisen in the past between tenant peasants and nai kǫng or agents who collected rents on behalf of the landlord, Čhaomün Sanphetphakdi. It was feared

that a serious confrontation might hamper the start of his project. And if this private enterprise was undertaken, the tracts along newly dredged canals might be privately owned and sold to peasants, following previous examples of canal excavation. The Minister reasoned that, in that case, the scheme would be for the sole benefit of Čhaomün Sanphetphakdi. Thus, in order to preserve those tracts from encroachments by private enterprise, the Ministry rejected his project and held them as na luang. In the absence of documentation, it cannot be established whether or not the proposed excavation of canals was fully undertaken by the Ministry, but according to the testimony of the villagers it appears that only the Khanomčhin canal was dredged and widened in that period.

After repairs to the canal were carried out by Phraya Kasetraksa and the governor of Krung Kao, some arrangements to facilitate cultivation such as digging lateral canals and ditches and construction of rong na (field huts) were made in those tracts occupied as na luang (K.S. 3.3/2). These tracts were located on the northern parts of the canal banks. Ayutthaya village is situated almost at the southern end of these na luang[22] and in addition, a vast unoccupied wilderness still extended further south. Therefore, the pioneering ancestors who settled at the village had a chance of claiming ownership to the cleared land further south, while some of them cleared and cultivated na luang as tenants. In the 1890's, gradual but steady migration into the village began in search of new frontiers of rice cultivation. The people who settled down in the rong na officially offered launched on na luang cultivation under terms of relatively low rent in kind, such as one or two thang of paddy per rai (K.S. 3.3/2).[23]

According to the villagers, in Ayutthaya village there were three peasant households who settled in such rong na. They were believed to have been originally phrai luang or corvee peasants attached to the King under the supervision of Phraya Kasetraksa. It is widely said among the villagers that they were tatooed (sak lek) with a figure of fish serrations and a registration number on their left fist, and were numerous in the northern part of the canal. They had to be pioneers, firstly mobilised to clear the na luang by Kasetraksa and subsequently settling down as tenants in pursuit of their living.

In addition to the settlement of phrai luang, another group of peasants who were thought to be already free from human bondage after the abolition of corvee conscription, settled in the village. Many of them claimed ownership of na ratsadon, while others became tenants renting riceland from landlords who also operated from the beginning of the pioneering days. Those landlords who accumulated holdings in this area mostly lived in Ban Phaen and Sikuk carrying on their various trades. It is said, however, there were a few landlords with large landholdings, like Čhaomün Sanphetphakdi, who were resident in Bangkok. Thus Ayutthaya village which experienced rapid development in the expansion of riceland from the start had a fairly large number of tenants and significant rented areas including some na luang.

The claiming of ricelands by peasants came to an end at the latest by the 1920's, and tenancy steadily increased throughout the Khanomčhin canal area, particularly in the 1930's. Although the tendency towards tenancy and landlessness continuously grew throughout the pre-war and post-war periods, few remarkable changes in the villagers' socio-economic life were brought about until the 1960's.

The improvement in irrigation in the 1960's provided, to some extent, a stable water supply to the fields along the canal and enabled some peasants to adopt the transplanting method of cultivation, though within very limited areas. Moreover during this period, manufactured inputs such as insecticides and weedkillers began to be applied to the broadcast-sown fields as well as to the more restricted area of transplanted fields. Tractor ploughing, although initially carried out by hired tractors from outside the village, was introduced in the early 1960's and has since been practised throughout the Khanomčhin canal area. Some rich peasants started to use their own tractors or smaller and cheaper power tillers which are customarily called khwai lek or iron water-buffalo. Some of these peasants also use rented tractors. Such industrial inputs which, in fact, became popular throughout the Chao Phraya delta region, provided not only higher yields but also an increase in cash flow through the whole process of rice cultivation as well as in the villager's daily consumption. Utilisation of wage labour in place of the traditional labour exchange became common at the stages of high labour demand in the farming calendar. In order to meet the considerable cash expenditure, most smallholders acquired heavy debts. It is said that some owner-operators who possessed relatively small holdings borrowed money from moneylenders and other sources, but frequently had to dispose of their land to clear off those debts, while many tenants who could not afford production costs (mainly due to high land rents and wages to be paid) had often to cease cultivation and became landless rural labourers. These general conditions were proceeding apace during the 1960's and are also seen, more or less, at the present time.

After the considerable changes in socio-economic conditions during the 1960's, which may be generally characterised as a general impoverishment of smallholders and tenants, the na luang was transferred by royal grant to its cultivators in 1976. This was performed by the Office of Land Reform for Agriculture attached to the Ministry of Agriculture and Co-operatives, as a part of land reform policy adopted by the government during the liberal period shortly after the popular uprising of 14 October, 1973. The tenants cultivating na luang, including four households in Ayutthaya village, became owner occupiers. However, this is not to say that this royal grant brought about a satisfactory solution to the growing problems of tenancy in this delta, nor in Ayutthaya village. The socio-economic conditions of the village which are originally derived from the pioneering reclamation are still to be observed at present, despite considerable changes.

4. Socio-economic Conditions of the Two Villages

(1) Occupation Structure

The two selected villages are fundamentally different and present a sharp contrast in their natural environments, with which their peasant rice farming systems are closely integrated. The farming systems currently practised within the two village communities are at the same time a result of the peasants' historical adaptation to the ecological setting, which can be traced back to their pioneering days, as we have shown in the previous section. It may be suggested that the two farming systems have followed different paths from the start in the particular socio-economic conditions surrounding the two villages. However, in order to give a contemporary outline of socio-economic conditions in the villages, we need to discuss further the occupation structure, land tenure,

operated area and rice production of the two villages in the 1974-75 cropping season.

The villages in Chiangmai and Ayutthaya are typical agricultural communities based on rice cultivation, as can be found throughout the farming regions of the Intermontane Basin type and of the Delta type respectively. Both have a majority of their households engaged in farming, if in some cases as farm labourers; farming households constitute 87 per cent of the total, while farm workers are 57 per cent of the total population in Chiangmai village; the proportions are 81 per cent and 53 per cent respectively in Ayutthaya village. All these farm households are primarily associated with wet-rice cultivation; the greater part of them actually operate farm holdings, while there are a small number of landlords who do not work on their holdings, either renting out their land or relying upon a considerable number of farm labourers for operation. As shown in Tables 17 and 18, the farm households in both villages can be classified into six groups in terms of land tenure status which will be discussed later. In both the villages the landless farm households, i.e. tenants and rural labourers, form the biggest group, amounting to around 60 per cent of the total farm households, with the landless and households who rented in at least part of their holdings accounting for more than 70 per cent of the total. Conversely, the landed groups such as landlords and owner-operators are rather a minority, accounting for 30 per cent in Chiangmai and 23 per cent in Ayutthaya. Taking the provincial averages into consideration as shown in the previous chapters, it is not surprising that landlessness and tenancy are as significant as indicated in these figures for both villages. So far as the distribution of farm households in terms of land tenure status is concerned, the

TABLE 17: Occupation Structure in Chiangmai Village, 1974-75

Occupation	No. of households (%)	Household population	Farm workers Number	Farm workers Average/ household
Agriculture				
Landlord	8 (4)	19	3	0.38
Landlord-operator	22 (11)	90	47	2.14
Owner-operator	31 (15)	123	83	2.68
Part tenant	16 (8)	72	46	2.88
Tenant	57 (28)	257	151	2.65
Rural labourer	68 (34)	262	179	2.63
Total	202 (100)	823 (4.07 per household)	509	2.52
Others				
Trade	13	46	10	
Official	6	23	2	
Factory labourer	4	24	5	
Dependent	8	15	0	
Total	31	108	17	
Sum total	233	931	526	

Source: 1974-75 Survey.

TABLE 18: Occupation Structure in Ayutthaya Village, 1974-75

Occupation	No. of households (%)	Household population	Farm workers Number	Farm workers Average/ household
Agriculture				
Lanldord	2 (3)	4	0	0
Landlord-operator	6 (9)	24	15	2.50
Owner-operator	7 (11)	45	28	4.00
Part-tenant	13 (19)	76	50	3.85
Tenant	18 (27)	87	50	2.78
Rural labourer	21 (31)	93	52	2.48
Total	67 (100)	329 (4.91 per household)	195	2.91
Others				
Trade	3	17	4	
Official	2	8	0	
Fishery	1	5	2	
Dependent	10	20	0	
Total	16	50	6	
Sum total	83	379	201	

Source: 1974-75 Survey.

villages are equally characterised by fairly advanced stratification in land tenure.

As in most areas in the two farming regions and throughout the country, the basic unit of production in the two rice-growing villages is the household, which consists normally of a nuclear family or a stem family bridging three and occasionally four generations. As we have already shown in the previous chapters, a farm household occasionally includes, in some areas, one or several rural labourers in addition to the family members. In Ayutthaya village only one household regularly hires a non-kin rural labourer who lives with the employer's family, while in Chiangmai village, there are five operating households whose family labour force is supplemented by a non-kin rural labourer who is regularly hired by them but lives separately. Except for these minor exceptions, the framework of farm household in both villages is basically coincident with the family, which is the fundamental decision-making unit in the course of production and consumption. Therefore, the family always performs a significant role in allocation of production resources such as land and labour. The average size of farm household is 4.07 in Chiangmai and 4.91 in Ayutthaya, both of which are under their respective provincial and regional averages of more than 5.

Throughout the process of rice cultivation, in both villages, the domestic labour force of the household is the major resource of labour, though supplemented by the traditional co-operative labour and/or wage labour. Since under traditional technology most farming operations other than transplanting and harvesting have basically been carried out by the labour of the operating household, the potential labour force available in it is of crucial importance throughout the

production process. Each farm household contains several farm workers who regularly work on the farm throughout the farming season, though due to the seasonality of farming activities characteristic of rice cultivation, they may perform various non-agricultural activities, especially during the agricultural slack season. In addition, even during the farming season, they may also spend a considerable time on fringe and informal activities such as fishing and repairing the house and farming equipment, which are essential for the subsistence of their family. Such farming population of 16 years and over are here regarded as farm workers.[24] The average number of farm workers per household in Ayutthaya village is slightly larger than that in Chiangmai: 2.91 and 2.52 respectively. This seems to be associated with the considerably larger operated area per household in Ayutthaya village, which is necessary for petty commodity production and was originally attained during the rapid reclamation period. The larger number of farm workers is particularly notable, amounting to approximately 4 per household, among the owner-operators and part-tenants in Ayutthaya, who normally operate quite large areas of more than 30 rai (Tables 18 and 24).

As many scholars have pointed out in their community studies, it is one of the major characterisitcs of labour utilisation in Thai peasant farming that in addition to the regular farm workers, the marginal labour units such as the elderly who have already retired, school-age children mainly under 16 years old and close relatives are mobilised for the periods of intensive labour demand and for light casual tasks (Fuhs and Vingerhoets, 1972: 88; SOAS, 1978: 22-23; Kamol, 1955: 82-83). Almost every farm household in both villages is able to mobilise a certain amount of such marginal labour units. In

recent years, however, the marginal labour force in a farm household, together with traditional co-operative labour, has tended to be replaced by hired labour under the increasingly monetised economy, especially in Ayutthaya village. Be that as it may, we can distinguish the main labour resources in the two villages: the domestic labour force of the household as the major resource consisting of the regular farm workers and the marginal labour units, and the other and supplementary resources supplied by the traditional co-operative labour or wage labour. With respect to the supplementary resources there is a marked difference between the two villages: the traditional exchange of labour is still at work despite the recent growth of wage labour in Chiangmai village, while it has declined and almost completely been replaced by wage labour in Ayutthaya village. This involves differentiated patterns of labour utilisation between the two, which will be discussed in detail in Chapter VIII. Another point which should be noted here is the fact that the largest numbers of farm workers in both villages come from the households of rural labourers who own no land to work. The greater part of this rural working population supplies supplementary labour to the operating households in the villages to meet the shortage of labour for the brief periods of labour demand in rice cultivation.

Although the economic activities of the two villages are highly concentrated on agriculture, there is a difference in specialisation in rice farming and in supplementary occupation between the two. Aside from the landlord relying basically on land rent and the rural labourer principally engaging in wage labour, the distribution of full-time farming households and of supplementary occupations among the operating households in the two villages are shown in Tables 19 and 20. The

TABLE 19: Distribution of Supplementary Occupation among Operating Households According to Land Tenure Status in Chiangmai Village, 1974-75

Occupation	Landlord operator No. (%)	Owner-operator No. (%)	Part tenant No. (%)	Tenant No. (%)	Total No. (%)
Full-time farming	18 (82)	15 (48)	2 (13)	3 (5)	38 (30)
Farming with supplementary occupation	4 (8)	16 (52)	14 (87)	54 (95)	88 (70)
Trade					
Retail shop	1	1	1	6	9
Rice mill	2				2
Middleman			1	2	3
Transport	1	5	2	6	14
Specialities					
Hairdressing		1			1
Basketry		1	1		2
Carpentry		1	1	4	6
Forest labour				7	7
Tüng leaf weaving		3	3	12	18
Wage labour					
Agr. piece-work		3	4	11	18
Agr. regular work				2	2
Miang plantation				3	3
Construction				1	1
Others		1	1		2
Total	22 (100)	31 (100)	16 (100)	57 (100)	126 (100)

Source: 1974-75 Survey.

TABLE 20: Distribution of Supplementary Occupation among Operating Households According to Land Tenure Status in Ayutthaya Village, 1974-75

Occupation	Landlord-operator No.(%)	Owner-operator No.(%)	Part tenant No.(%)	Tenant No.(%)	Total No. (%)
Full-time farming	4 (67)	5 (71)	5 (38)	5 (28)	19 (43)
Farming with supplementary occupation	2 (33)	2 (29)	8 (62)	13 (72)	25 (57)
Trade					
Retail shop	2		1		3
Middleman		1	1	1	3
Transport			2	1	3
Specialities					
Tailoring		1			1
Basketry			1		1
Fishery			1	2	3
Wage labour					
Agr. piece-work			2	6	8
Construction				3	3
Total	6 (100)	7 (100)	13 (100)	18 (100)	44 (100)

Source: 1974-75 Survey.

full-time farming household here means, for the sake of convenience, those households whose net farm income accounts for more than 70 per cent of the total net income. The farming households with supplementary occupation are accordingly those households whose net non-farm income is more than 30 per cent of the total, and an occupation from which a household draws the largest income from sources other than their own farm is regarded in the tables as the household's supplementary occupation. It is then clear that full-time farming households are rather in the minority in both villages, and the proportion of those to the total number of households is rather higher in Ayutthaya village with 41 per cent, against 30 per cent in Chiangmai village. It is also notable that the proportion of full-time farming households is generally higher in the landed peasant groups in both villages, and is quite low especially in the part tenant and groups in Chiangmai. These figures suggest that the smallholders and tenants are no longer able to rely solely on farming or at least on rice cultivation and have to seek supplementary income in non-farm activities.

In Chiangmai village, cash cropping is confined to cultivation of soybeans (thua lüang), tobacco (ya sup) and off-season rice on a quite small scale, mainly due to insufficient water supply in the dry season. Such underdevelopment of cash cropping in Chiangmai's subsistence farming seems to lead to heavier dependence on supplementary occupations. On the other hand, Ayutthaya's rice cultivation has long been aimed at cash cropping and despite the prolonged deep flooding in the rainy season, the marked deficiency of water supply in the dry season makes any other alternatives hardly possible. Given the relatively large operating area and the long-established rice marketing, Ayutthaya's rice monoculture still maintains a rather higher ratio of

full-time farming households to the total households (Chiangmai: 30 per cent, against Ayutthaya: 43 per cent) as shown in Tables 19 and 20.

Even in such village communities concentrating on rice production as the villages under study, there has always been some development of non-agricultural sectors and various kinds of supplementary occupations. In both villages, in fact, it is said that there were some farm households who engaged in small-scale trade, handicrafts and wage labouring, at the latest, since the turn of the century. At present, as shown in Tables 19 and 20, both villages contain a significant number of such households with their supplementary occupations varying considerably.

In both the villages the trade activities requiring heavier capital investment such as keeping a retail shop and operating a rice mill are restricted to the landed groups of peasants, while pedlars including petty shopkeepers, selling quite small quantities of groceries and food are found among landless groups, especially in Chiangmai village. The two local rice mills established in the early 1960's in Chiangmai village are operated by landlord-operators for milling home consumption paddy as well as for small-scale rice trading. On the other hand, Ayutthaya has no rice mill, because there are some long-established mills incorporated in the large-scale networks of rice marketing in the adjacent village and in the major centres along the Chao Chet Bang Yihon canal. Ayutthaya's three local middlemen, each equipped with more than one cargo boat (rüa krachaeng) are involved in rice trading in and out of the village, while Chiangmai's middlemen are merely dealing with such livestock as water-buffalo and pig on a small scale.

As for transport, reflecting differences in physical conditions, motor-boat services for passengers and goods have become popular in the water courses around Ayutthaya village, while in Chiangmai village the traditional ox-carts (lo ngua) are still in wide use, and a considerable number of poor peasants use them to carry logs and other forest products out from the pae stretching to the west of the village in order to obtain supplementary cash income. In the latter village, fifteen households engage in such transport services using their own ox-cart and only one wealthy landlord-operator operates regular services between the village and Chiangmai city area by a mini-bus (rot song taeo) converted from a small lorry for carrying passengers.

Basket-weaving, fishing and other supplementary specialist jobs are to be found, though often sporadic and on very small-scales, especially among the poor peasants in both villages. In both villages, most peasants, to a greater or lesser extent, engage in fishing and collecting edible plants and insects, firewood and other raw materials for artifacts for their domestic consumption. Given the richer forest resources in the pae surrounding the village, Chiangmai's peasants obviously spend much more time in these subsistence activities. Among various activities in the forest, the collecting of fallen leaves from tüng (Dipterocarpus tuberculatus) and forest labour such as woodcutting and charcoal-burning have recently become important sources of cash income for the poor peasants, including rural labourers, in Chiangmai village. Tong tüng (tüng leaves) gathered in the pae during the latter half of the dry season are woven with thinly split bamboo to make sheets of roofing material. The finished products of tong tüng sheet are sold individually to collectors sent by the companies dealing with construction materials in Chiangmai city. Collecting and weaving

tọng tüng has become popular in most farm households of the village in recent years and provides a considerable proportion of the cash income of the fourteen households who are poor peasants with no or very small holdings. Likewise, charcoal-burning and woodcutting in the pae, which must have been continuously carried out for subsistence for many years, but which are now illegal in the area of forest reserve, now provide opportunities for obtaining cash income for the seven tenant households and for many other rural labourers as well.[25] Combined with transport by traditional ox-carts, these forest activities currently have a very significant role in assisting the poor peasants within a village community to survive under the increasing land hunger.

Wage labouring on the farm and occasionally in non-agricultural sectors is also widespread in both villages, especially among the poor peasants including some smallholders. In both villages the greater part of wage labouring is agricultural labour which is paid on a piece-work or day-labour basis for tasks mainly in the periods of transplanting and harvesting. Since we shall see the conditions of wage labour among the rural labourer's households in relation to labour utilisation among the operating households in Chapter VIII, we here touch upon only the wage labour among the operating households as a supplementary occupation. In Chiangmai village, there are two tenant households regularly hired to look after the estates growing longan (lamyai) and other fruit trees, which are operated on the southwestern foothills by urban based capitalist developers. Moreover, some members from three tenant households together with rural labourers work on miang plantations located in mountanous areas in Mae Taeng district immediately north of Mae Rim district, for about five months from late April to September. Workers on th se plantations must stay in accommodation on the plantation, where they have to perform

hard labour at low wages, harvesting miang leaves and working in the process of fermentation under extremely unhealthy and unpleasant working conditions.[26] A few households have acquired opportunities for wage labouring at a construction site in Chiangmai city, a rice mill at Mae Rim town, and a tobacco leaf drying factory situated within Chiangmai village. In the case of Ayutthaya village, wage labour other than agricultural piece-work is mainly at construction sites in Bangkok, where some members from three tenant households worked during the dry season in 1974-75.

A comparison of occupation structure between the two villages reveals the following aspects. In Chiangmai's subsistence farming, which is characterised by small operating areas and an underdeveloped cashcrop economy, the majority of operating households including owner-operators with smallholdings have to depend upon supplementary occupations. Reflecting the underdevelopment of the non-agricultural sector in urban areas, their employment opportunities are almost all confined to the village and adjacent countryside. In such circumstances, forest labour, its associated activities, and wage labour in agriculture have become of crucial importance for the poor peasants. On the other hand, Ayutthaya's rice farming as petty commodity production, supported by larger operating areas, allows the existence of a relatively large number of full-time farm households, especially among the landed groups. It is one of the characteristics of highly commercialised agriculture that there are some operating households involved in rice trading as middlemen. Although opportunities for wage labour come mainly from the agricultural sector inside and outside the village, it should be noted that some peasants work away in Bangkok during the off-season.

(2) Land Tenure, Operated Area and Rice Production

As many scholars have suggested, in peasant farming land tenure conditions such as size of landholdings and social relationships of land tenure have a direct effect upon productivity as a whole. At the same time, under the peasant economy with low capital investment, land tenure represents the crucial factor of social stratification in terms of wealth, power and prestige (Shanin, 1971a: 295; Nash, 1965: 28). In connection to these, three native categories of land tenure in both villages seem to represent socio-economic status among the peasants; the operating household falls into two categories: čhao khǫng thidin or land owner and phu chao thidin or one who rents in land; outside these two groups of operating households, there is a term khon rap čhang (khon hap čhang), denoting the rural labourer. In particular, the rural labourer who has no land to work presents a sharp contrast to the other two in terms of the opportunity for rice production. However, due to complex relationships of renting and the wide range of landholdings, the dichotomy of čhao khǫng thidin and phu chao thidin does not necessarily reflect the detailed difference in land tenure among the operating farm households. So, we need a further calssification of land tenure status which takes into account the renting relationship and the size of holding, in order to reveal a more realistic picture of land tenure in both villages. As shown in Tables 21 and 22, the land tenure status in both villages can be classified into six categories.

Landlord: The landlords in both villages are basically local landlords living within their own village, who do not work on their own riceland and rent out its entire area to tenants or part tenants. They primarily rely upon rent levied for their incomes. Their holdings

TABLE 21: Area of Riceland Owned and Rented in Chiangmai Village, 1974-75

Land tenure status	No. of households	Av. age of household head	Area owned (%)	Av. area/ household	Area rented out	Area rented in
Landlord	8	65	111.00 (17.6)	13.88	111.00	
Landlord-operator	22	61	261.50 (41.3)	11.89	204.75	9.00
Owner-operator	31	54	204.50 (32.3)	6.60	2.00	
Part tenant	16	47	48.25 (7.6)	3.02	2.75	42.00
Tenant	57	45	4.75 (0.8)	0.08	1.50	354.00
Rural labourer	68	52	0.75 (0.1)	0.01		
Others	31	48	2.00 (0.3)	0.06		
Total	233		632.75 (100.0)	2.72	324.00	405.00
Renting within the village					315.00	315.00
Renting to and from other villages					9.00	90.00

Landlord : Landlords who engage in no farming throughout the year.
Landlord-operator: Landlords who operate the main season rice cultivation or the off-season cultivation including upland cropping.
Owner-operator : Households who own the entire operated area over 4 rai.
Part tenant : Households who rent in riceland in addition to their own land, and smallholders under 4 rai.
Tenant : Households who own almost no riceland and rent in the entire operated area, and smallholders under 1.50 rai.
Rural labourer : Households who own almost no riceland and principally engage in wage labouring.
Others : Non-agricultural households.

Source: 1974-75 survey.

TABLE 22: Area of Riceland Owned and Rented in Ayutthaya Village, 1974-75

Land tenure status	No. of households	Av. age of household head	Area owned (%)	Av. area/ household	Area rented out	Area rented in
Landlord	2	60	96.00 (9.9)	48.00	96.00	
Landlord-operator	6	54	322.75 (33.1)	53.79	153.75	1.00
Owner-operator	7	50	226.50 (23.2)	32.36		
Part tenant	13	45	300.25 (30.8)	23.10		229.50
Tenant	18	44	22.00 (2.3)	1.22	5.00*	279.75*
Rural labourer	21	46	2.00 (0.2)	0.10		
Others	16	56	5.00 (0.5)	0.31	5.00	
Total	83		974.50 (100.0)	11.74	259.75	510.25
Renting within the village					157.75	157.75
Renting to and from outside the village					102.00	352.50

* The figures include 5 rai which was rented in by Household No.12 and rented out to No.13.

Landlord : Landlords who engage in no farming throughout the year.
Landlord-operator: Landlords who operate the main season rice cultivation and/or the off-season cultivation including upland cropping.
Owner-operator : Households who own the entire operated area over 10 rai.
Part tenant : Households who rent in riceland in addition to their own land, and smallholders under 10 rai and over 5 rai.
Tenant : Households who own almost no riceland and rent in the entire operated area, and smallholders under 5 rai.
Rural labourer : Households who own almost no riceland and principally engage in wage labouring.
Others : Non-agricultural households.

Source: 1974-75 Survey.

are not so large and have been acquired mainly through inheritance and small-scale purchasing from other peasants in their own or nearby villages. In contrast to the absentee landlords with quite large accumulations of landholdings, living normally outside villages, they are exclusively retired old peasants who were previously landlord-operators or owner-operators.

Landlord-operator: The landlord-operators are those who work on a part of their holdings, and rent out the remaining area to tenants or part tenants. In Chiangmai village about 45 per cent of the landlord-operators (10 out of 22 households), receive enough paddy as land rent for their consumption, and cultivate only such upland cash crops as soybeans and tobacco on a small scale during the dry season, while in Ayutthaya all landlord-operators cultivate non-glutinous rice, which is the sole feasible cash crop in the deltaic environment. In both villages they include a considerable number of old aged peasants who had previously worked on the entire area of their land. Although the size of their landholdings varies considerably, most of the landlord-operators, together with the landlords and some owner-operators, form a class of 'rich peasants',[27] having a constant surplus from land rent and produce, occasionally combined with income from supplementary occupations.

Owner-operator: The owner-operators are those who own the entire area operated. In the case of Chiangmai village, however, very small landholders operating less than 4 rai of their own land are approximately classified as part tenant or as tenant, because such small size of holding is very unlikely to produce enough paddy for food consumption for a whole family. For the same reason, 10 rai is regarded here as the lower limit of land-holdings for the owner-operator in Ayutthaya village. The size of

landholding of Chiangmai's owner-operators is rather small, ranging between 4 and 11 rai and can barely support the subsistence needs for home consumption. Therefore, about a half of the owner-operators have to seek cash income in supplementary occupations. On the other hand, most of Ayutthaya's owner-operators, who own a fairly large area, are able to produce paddy for sale after securing enough for their home consumption. Thus, the owner-operators in the two villages present a sharp contrast to one another not only in size of landholdings but also in economic orientation of their rice cultivation.

Part tenant: Likewise, the part tenants who rent in riceland in addition to their own land differ between the two villages. The category of part tenant in Chiangmai village includes a few small owner-operators owning riceland of less than 4 rai but over 1.5 rai, while in Ayutthaya village it includes holdings of less than 10 rai but over 5 rai. Most part tenants in Chiangmai village with a small piece of land rent in some additional land only to attain holdings viable enough to meet their subsistence requirement. However, only 4 part tenants can do so, and the rest still suffer a shortage of land for cultivation. On the other hand, Ayutthaya's part tenants are basically the landed group of peasants owning 8 to 43 rai who can create, by renting in extra land, a more efficient farm size for the available labour force, capital and technology to produce surplus paddy to be put on the market.

It is difficult, therefore, to discuss and to regard the owner-operator and the part tenant as categories common to both villages. Instead, they should be appropriately placed in the individual village context. So, in the context of Chiangmai's subsistence farming, it can be said that the greater part of owner-

operators and only a few part tenants form a relatively narrow range of 'middle peasants', who can manage to produce paddy for home consumption by cultivating their own land and rented land. Most part tenants belong to the lower class of peasants consisting of the tenants and the rural labourers. In contrast, Ayutthaya's 'middle peasants' are represented by the greater part of owner-operators and part tenants who own and operate a fairly large area for production for sale.

Tenant: The tenants are those who own no or very little rice-land and rent in almost the entire area operated, but they include a few small owner-operators owning less than 1.50 rai in Chiangmai, and less than 5 rai in Ayutthaya. They are able to engage in rice cultivation, with their own instruments of production, basically by renting in riceland from landlords and landlord-operators within and outside the village, including absentee landlords, especially in Ayutthaya. The position of tenant is generally weak and vulnerable in terms of the tenancy customs, in which the landlords have a secure position to manipulate land rent and to arbitrarily change tenants. The only exception is in the tenancy between parents and their children, which is frequently to be found in the case of Chiangmai village. Under the considerable burden of increasing land rent, together with other high production costs, they have increasingly found it difficult to produce more than subsistence consumption in recent years. Even in the highly commercialised farming of Ayutthaya, most tenants who operate 16.49 rai on average are unlikely to produce much surplus. The greater part of tenants in both villages have to, in fact, derive some cash income from wage labouring and other occasional activities.

Rural labourer: Rural labourers rely principally upon wage labour and currently form the largest peasant group and are increasing in number in both villages. The majority of rural labourers have to seek various occasional jobs and sporadic activities in addition to agricultural tasks in rice cultivation, which can be provided only in the brief periods of labour demand under the traditional farming technology. In both the villages, they are economically related as hired labour not only to the upper strata of peasantry, but in recent years to almost every operating farm household.[28] Within the current situation of land tenure status in the two villages, the mass of rural labourers, together with most tenants, and with the part tenants in Chiangmai village, suffer being the most oppressed and exploited class of peasantry or 'poor peasants'. The great mass of these 'poor peasants' are barely able to survive, suffering from frequent deficiency of rice for home consumption. Whether in subsistence or in petty commodity production, they primarily concentrate their effort through cultivation of the rented land and wage labouring on acquisition of rice for food or the equivalent cash for their survival.

The classification of land tenure status into the six categories mentioned above is an attempt not to show the overall structure of land tenure situation common to both farming regions, but to reveal its present situation within the village context. It can be seen that the classification of peasant category in the villages will facilitate the further discussions on technological aspects and relationships of labour utilisation among the operating households, to which we shall turn in subsequent chapters. For the moment, we will turn to a brief account of the two villages, relating to the distribution of area owned

and area rented, and the distribution of area operated among these categories of peasants.

Between the two villages, as shown in Tables 21 and 22, there is a considerable difference in size of landholdings; the average size per household is 2.72 rai in Chiangmai and 11.74 rai in Ayutthaya, and it is 3.12 rai and 14.47 rai per farm household respectively. This indicates that the land resource is clearly insufficient for the farming population in Chiangmai village, while Ayutthaya village is better off, although it is still scarcely adequate. As we have seen earlier, one of the major reasons for such a difference may be the different processes of reclamation in these villages. In Chiangmai village, after the pioneering reclamation of riceland within the narrow alluvial valley in the early nineteenth century, the expansion of riceland more or less ceased, at the latest, by the 1930's, with only the minor addition of the Mae Raem field (M2) in the 1950's. During the past 170 years or so, the initially cleared land with later additions has been successively subdivided into fragments through at least five or six generations. Relatively scarce resources for riceland and high population growth have resulted in the current fall in the average size of landholdings. On the other hand, the reclamation of Ayutthaya's riceland is a relatively recent phenomenon dating from the extraordinary boom of riceland expansion which occurred early this century. The relatively large area of riceland claimed and transformed from the deltaic wilderness by the pioneer peasants has been utilised for the short period of 60 or 70 years or 2 to 3 generations. Although peasant land ownership has been eroded to some extent by the growth of absentee landlords during those years, a good number of the rich peasants have retained their

inherited share and have occasionally even acquired some extra land through purchasing from the poor peasants during the past few decades. At the same time, the recent higher out-migration[29] of younger people to Bangkok Metropolis is contributing to the prevention of excessive subdivision of the peasant holdings. It should be noted, however, that Ayutthaya's average size of holding per household is still considerably lower than that of the socially expected size amounting to about 20 to 25 rai, as we have seen in Chapter IV.

There is also a difference between the two villages in distribution of landholdings among the farm households. In Chiangmai village, the landlords, landlord-operators and owner-operators own more than 90 per cent of the total riceland, and only a small amount of land belongs to the part tenants. On the other hand, as we have seen already, many of Ayutthaya's part tenants, basically a landed group of peasants, perform a significant role in rice production under the highly commercialised farming system as a whole. So far as the average holdings are concerned, in Ayutthaya, all the landed groups, from the part tenants upwards, have average holdings of more than the socially expected size (20 to 25 rai) and present a sharp contrast to other lower categories with almost no riceland. In Chiangmai, the disparity in landholdings between the tenurial categories is not so profound as observed in Ayutthaya and only a small number of landed peasants from the landlord and landlord-operator groups retain more riceland than the socially expected level (8 to 10 rai), as we have discussed in Chapter III.

With respect to the rented areas of riceland there is also a marked difference between the two villages. Of the total landholdings in Chiangmai, about a half is rented out, mostly to the tenants and part tenants within the village. The total area rented in amounts to

405 rai, of which 315 rai or 78 per cent come from inside the village, and only 90 rai or 22 per cent are resources from outside the village. These facts, together with the existence of numerous renting households, imply that there are intricate relationships of small-scale renting within the village. On the other hand, in Ayutthaya village the greater part of the peasants' holdings are worked by their owners. Only 27 per cent of the total landholdings are rented out to peasants either inside or outside the village. There is quite a large area rented in by the tenants and part tenants, amounting to 510.25 rai, but 352.50 rai or about 69 per cent of this area is owned by people from outside the village. This indicates the presence of absentee landlords, though some local petty landlords outside the village actually offer certain amounts of land for cultivation by Ayutthaya's peasants. It should also be noted that, reflecting the historical process of land reclamation, the ricelands rented out by absentee landlords include 52 rai of na luang (royal riceland) in four plots. In relation to tenancy, we can here suggest a major contrast between the two villages; Chiangmai's tenancy is profoundly characterised by relationships of small-scale renting between the rich peasants and the poor peasants within the framework of subsistence farming, while in Ayutthaya's commercially oriented rice farming, absentee landlordism is of great significance.

The general characteristics of land tenure situation have indeed an effect upon the area operated and the rice production of the farm households, as shown in Tables 23 and 24. Operating households in the tables mean those who carried out wet-rice cultivation in the 1974-75 season, so that a few households who did not do so for some reason are excluded.[30] In Chiangmai village, the area operated is quite small

TABLE 23: Area Operated and Total Rice Production in Chiangmai Village, 1974-75

Land tenure status	No. of households	Area operated*			Area/ household (rai)	Gross product* (thang)	Gross pro./ household (thang)
		Owned (rai)	Rented (rai)	Total (rai)			
Landlord-operator	13	53.75	9.00	62.75	4.83	3,614.00	278.00
Owner-operator	31	200.50		200.50	6.46	11,644.50	375.63
Part tenant	14	42.25	42.00	84.25	6.02	4,678.00	334.14
Tenant	54		354.00	354.00	6.56	18,339.00	339.61
Total	112	296.50	405.00	701.50	6.26	38,275.50	341.75

* Excluding the off-season cultivation (double cropping) by three tenant households, which was measured 11.00 rai and produced 502 thang of paddy.

Source: 1974-75 Survey

TABLE 24: Area Operated and Total Rice Production in Ayutthaya Village, 1974-75

Land tenure status	No. of households	Area operated*			Area/ household (rai)	Gross product* (thang)	Gross pro./ household (thang)
		Owned (rai)	Rented (rai)	Total (rai)			
Landlord-operator	6	169.00	1.00	170.00	28.33	5,670.00	945.00
Owner-operator	7	226.50		226.50	32.36	7,639.00	1,091.29
Part tenant	13	300.25	229.50	529.75	40.75	15,712.00	1,208.62
Tenant	18	22.00	274.75	296.75	16.49	9,586.00	532.56
Total	44	717.75	505.25	1,223.00	27.80	38,607.00	877.43

* Excluding the off-season cultivation (double cropping) by a tenant household, which measured 8.00 rai and produced 416 thang of paddy.

Source: 1974-75 Survey.

with an average of 6.26 rai, ranging between 1.75 and 14.00 rai. This figure roughly corresponds to the regional average of the Intermontane Basin type of farming, but is higher than the Chiangmai provincial average of 5.6 rai, as shown in Chapter III. The average yield measures 54.56 thang per rai (3.44 tonne/ha), which represents quite a high yield level even in the Intermontane Basin farming region. Although such a high yield level is partly attributable to various physical conditions such as soil, it is undoubtedly also the result of the highly efficient technology of rice farming to which irrigation is central, as we shall see in the subsequent chapters. Despite the higher yield level, however, the average gross product per household is very small, amounting to only 341.75 thang. The average area operated amounts to only 23 per cent and the gross production 39 per cent on average of the comparable figures for Ayutthaya village.

Taking into consideration the peasants' production economy as previously shown in Table 9, it is clear that the average level of gross production (341.75 thang/household) barely meets the necessary paddy for home consumption or khao kepwai kin and other production costs leaving very little surplus for cash expenditure. This is sometimes also the case for owner-operators. For most part tenants and tenants at near average level, the situation is worsened by the need for further payment for land rent and, as a consequence, they perpetually suffer a deficiency of paddy for consumption.

Under such circumstances, a good number of operating farm households together with the rural labourers are forced to cultivate upland rice (khao hai) by shifting cultivation method[32] in the western pae in order to make good the deficiency in food production. The suitable

lands for upland rice cultivation in the pae are limited and scattered considerable distances, normally 2 to 5 km, from the settlements. This imposes a great deal of hardship on the cultivators, in land preparation, weeding and transport, so that the cultivation tends to be restricted to the households with a younger labour force. As shown in Table 25, there are 42 households of upland rice cultivators, mainly from the categories of tenant and rural labourer, operating 76.25 rai some 11 per cent of the total area operated in wet-rice. The yield of upland rice is relatively low, measuring 25.46 thang/rai (1.61 tonne/ha) on average in 1974-75, and is subject to violent fluctuations. The cultivators tend to be discouraged by difficulties such as lower labour productivity, long distance from the settlements and, above all, the strict legal control over the usage of 'forest reserve'. Therefore, most cultivators operate only a small area of as little as one or two rai, which can barely produce the amount of paddy necessary for one man's yearly consumption.

In Ayutthaya village, on the other hand, the area operated in wet-rice is fairly large, amounting to 27.80 rai on average, and varies enormously from 6.00 to 60.00 rai. The average is higher than that of the Delta farming region as a whole and also higher than the 22.0 rai of Ayutthaya provincial average (Table 12). The average yield is 31.57 thang per rai (1.99 tonne/ha), which represents a fairly average level in both Ayutthaya province and the Delta farming region, but is considerably lower than that of Chiangmai village. In contrast to Chiangmai village, the area operated and the gross production vary considerably in terms of land tenure category. In particular, the part tenants, combining their own landholdings with additional rented lands, attain the largest gross production on average. On the other

TABLE 25: Area Operated and Total Production of Upland Rice Cultivation in Chiangmai Village, 1974-75

Land tenure status	No. of households	Area operated (rai)	Area/ household (rai)	Gross product (thang)	Gross pro./ household (thang)
Landlord-operator	1	1.00	1.00	30.00	30.00
Owner-operator	5	14.00	2.80	376.00	75.20
Part tenant	3	3.00	1.00	125.00	41.67
Tenant	13	19.00	1.46	466.00	35.85
Rural labourer	20	39.25	1.96	944.00	47.20
Total	42	76.25	1.82	1,941.00	46.21

Source: 1974-75 Survey.

hand, the area operated and production of the tenants deviate widely from those of the other three categories of peasants.

Under the highly commercialised farming and the widespread practice of rice marketing, it is commonly recognised among the village peasants that about 20 to 25 rai of operated area or 500 to 875 thang of gross rice product is normally required to maintain the level for minimum subsistence, as shown in Table 13. Many of the households in the three upper categories, therefore, seem to be capable of attaining a viable production level by rice cultivation alone. It is clear, however, that many tenants producing some 500 thang of paddy seem to find it difficult to manage their household economy after payment of production costs, including land rent which normally accounts for around 20 to 30 per cent of the total product. So far as the area operated and gross production are concerned, we can see a great difference between the three upper categories and the landless tenants, the latter tending to share the position of 'poor peasants' with the rural labourers who can increasingly participate in wage labouring.

When we compare the land tenure situation and farm size (area operated) between the two villages, some marked differences can be pointed out. First of all it is quite notable that there is a great disparity between the two in landholdings and in the area operated as a whole. It can be seen that this disparity, originally derived from the basic area available for clearance and from the historical processes of reclamation, has largely remained up to the present day, determining the contrasting orientation of peasant farming, i.e. subsistence production in Chiangmai and petty commodity production in Ayutthaya. Within the framework of Chiangmai's subsistence farming, small landholdings are owned by the upper three categories of peasants, and

small-scale renting relationships are common between the landed and the landless within the village community. The area operated is generally small and differs little between the categories of peasants. Those who are able to produce sufficient paddy to meet their subsistence are relatively restricted to a smaller number of peasants, and most part tenants and full tenants are faced with a deficit in rice consumption supplies. In contrast to Chiangmai's subsistence farming with its wretchedly inadequate land resources, Ayutthaya's farming has been developed basically for petty commodity production with relatively large land resources owned by the upper four categories of peasants and by absentee landlords outside the village as well. The large area of riceland operated by the landed peasants including the part tenants normally yields enough for market disposal in addition to providing paddy for subsistence requirements. However, many tenants with smaller operating areas have increasing economic problems under the highly commercialised agrarian society of the delta region.

5. Conclusions

In this chapter we have attempted to give a basic outline of the two villages selected in Chiangmai and Ayutthaya through which we intend to examine the present circumstances of two distinctive types of peasant farming. The two villages selected present a sharp contrast in ecological setting and associated farming technology: Chiangmai village is situated in a tributary valley, a northwestern marginal area of the Chiangmai basin, where the sophisticated transplanting culture has been developed with limited land resources, relying upon the well-maintained müang fai irrigation systems; in Ayutthaya village, located in the deep flooding Retarding Basin of the delta, rice

cultivation is basically characterised by broadcast-sowing culture depending on natural precipitation and annual inundation. We have examined the outline of these contrasting villages with respect to the general aspects of village community, the historical background and the contemporary socio-economic conditions. Although a number of marked differences can be seen between the two villages in the social and economic life of the peasants, some striking contrasts of particular relevance to their peasant farming should be noted.

In the historical context, the two villages have followed markedly different roads of development. After the settlement by Lü captives in the early nineteenth century, Chiangmai's rice cultivation seems to have been consistently characterised by subsistence farming, with gradual small-scale reclamation of the limited land resources in the narrow alluvial valley. Although the peasants underwent a considerable socio-economic change during the period of Siamese annexation and more recently have been confronted with the serious problems of landlessness and tenancy, the basic orientation towards subsistence production has not drastically changed up to the present day. In contrast, there has been a consistent orientation towards the market in Ayutthaya. The pioneering settlement and reclamation of the wilderness in Ayutthaya village began with the extraordinary boom in rice-export agriculture, prevailing in many parts of the young delta region at the beginning of this century. Ayutthaya's reclamation by peasants proceeded rapidly and on a fairly large scale, but has obviously been accompanied by accumulation of large holdings by absentee landlords. During the period of such rapid reclamation and after, Ayutthaya's farming has long been involved, to a significant degree, in the export-rice market economy in which the peasants regard

their produce as a commodity for sale as well as a staple food crop. This clear contrast between the two villages in reclamation process and peasant economic aspiration can indeed be identified with the general concept of the two farming systems discussed in the previous chapters.

The contemporary contrasts in land tenure situation and occupation structure between the two villages are also related to these historical processes of land reclamation. Within its subsistence farming, quite small-scale holdings are characteristic of Chiangmai village. Under the extreme deficiency of land resources, this has consequently resulted in the development of an intricate pattern of small-scale renting of landholdings within the village, and above all in the impoverishment of the poor peasants including the part-tenant, full tenant and a large number of rural labourers. In Ayutthaya's petty commodity production structured within rice-export agriculture, the village has still retained relatively large holdings operated by the landed peasants, and the development of absentee landlordism is one of its major characteristics. These contrasts in the land tenure situation and the related socio-economic conditions represent the current local situation within the wider context of socio-economic relations of the country. Taking into account these contrasts, we shall, then, examine in the subsequent three chapters the essential question of how these distinctive tendencies of peasant farming are related to the farming technology actually practised in the two villages.

CHAPTER VI

FARMING TECHNOLOGY I: IRRIGATION

The main objective of this chapter is to examine the contrasting irrigation practices as a crucial part of farming technology in rice cultivation, in terms of the ecological, technological, and socio-economic contexts of the two selected villages. As we have already discussed, the irrigation method and its practices are basically governed by the physiographical and hydrological conditions of the area, and have significant relationships with the entire course of rice cultivation. The present chapter is an attempt to elucidate the sets of relationships involved in irrigation by investigating and comparing the radically contrasting practices of the two villages in respect to physical structures, organisational arrangements and management in operation and maintenance of the physical structures. We shall first suggest some general contrasts of irrigation in the two villages in order to provide a framework of comparative discussion. The detailed examination for Chiangmai village will be focused on the indigenous physical systems or müang fai and their associated organisations and managements. This is subsequently followed by a discussion of the contrasting practices in Ayutthaya village where they are still an almost total dependence on the monsoon rainfall and annual inundation, though the government's irrigation improvements have been carried out. Through a comparative discussion of irrigation practices we shall illuminate the fundamental differences between the two villages in the very core of farming technology of rice cultivation.

1. General Contrasts in Irrigation

As we have already discussed, there is little doubt that the ecosystem of the wet-rice field requires adequate water supply to maintain the flooded conditions in which its elements can interact efficiently. Because of the problems of uncertain amounts and variability of rainfall associated with the monsoon rainfall pattern, irrigation, or more broadly, some form of water control, is inevitable and has been widely practised by peasants in almost every wet-rice plot in this country. For the peasants both in Chiangmai and Ayutthaya villages, irrigation has always been one of the most crucial factors in the technology of rice cultivation, regardless of whether it is artificial or natural, and whether it is collective or individual.

With respect to the ecological and socio-economic contexts, we have to give particular consideration to irrigation practised among the peasants in the following respects. First, irrigation is a complex technology which involves various levels of engineering to increase control of water and which ultimately has a crucial effect upon the cropping pattern (Ruthenberg, 1976: 163-164, 169). Secondly, in irrigation in rice farming the physical and engineering facilities are closely articulated with organisational arrangements of the peasant society (Leach, 1961: 300; Geertz, 1967: 229-230; Coward, 1979: 29). The organisational arrangements for operation and maintenance of the physical structures are of fundamental importance in this respect. Since the first aspect of irrigation practices will be discussed in the next chapter in relation to the farming operations in various types of cultivation, we here intend to focus mainly upon the latter aspect by comparing the irrigation practices of the two villages.

In order to facilitate the subsequent discussions in detail, it will be useful here to make some general comparisons in irrigation practices between the two villages. As we have already mentioned, a marked difference can be seen between the two in ecological setting, which has a decisive effect upon water availability for rice cultivation. In the narrow alluvial plain of the Mae Rim valley, Chiangmai's irrigation is characterised by a well-organised and small-scale gravity type of irrigation, which is identical with the Valley and Alluvial Fan type of müang fai system characteristic of the Intermontane Basin type of farming system. With the müang fai systems consisting of a small weir (fai) and a regular network of canals (müang), Chiangmai's rice farming is capable of supplementary main season irrigation, particularly during the most critical period of vegetative growth lasting from nursery culture to the tillering stage. With the sophisticated water allocation through the müang fai system, there has been a development of transplanting culture which requires elaborate water control in each plot. It is reasonable to suggest that the labour-intensity of Chiangmai's rice cultivation, observed in a whole series of farming operations, is also based upon the ecological context of this sophisticated irrigation technology.

Ayutthaya's rice farming may be placed at the other extreme. The massive hydrological system of the Retarding Basin of the Chao Phraya delta, which is characterised by a seasonal alternation of extremely deep inundation and extreme dryness, makes any attempt at peasant water control almost impossible. In such an environment, Ayutthaya's farming has no local system of irrigation, but has been incorporated in the vast scheme of water control of the Greater Chao Phraya project since the end of the 1950's. Given the imperfect

development of water control, at least in the Khanomčhin canal area, the broadcast-sowing culture of 'floating rice', basically relying on the natural precipitation and annual inundation, is still predominant. Although a well organised adaptation, agriculture here is accompanied by a great deal of uncertainty due to the monsoon rainfall and the inundation which could be called 'flooding irrigation'. The less labour-intensive nature of Ayutthaya's rice cultivation, particularly its predominant method of broadcast-sowing, is associated mainly with the uncontrollable hydrological environment which prevents the same elaborate care of plants as practised in Chiangmai's transplanting culture.

Bearing in mind these general ecological contrasts, we may expect to find radical differences in the organisational arrangements of irrigation practices in the two villages. As many scholars have pointed out, in many cases in irrigated rice farming, the hydrological and engineering aspects of facilities, including the amount of available water, physical structures and their durability, determine the operational and maintenance requirements (Coward, 1979: 29). There are certain basic managerial requirements in relation to the operation and maintenance of the physical system, in order to make it technologically and socio-economically efficient. In every irrigation system, among the various activities, water allocation, routine maintenance, conflict resolution and organisation of associated rituals are of fundamental significance (Hunt and Hunt, 1976: 395-396).

In the following sections, therefore, we take a close examination of physical structures and systems, and particularly in Ayutthaya, of the pattern of inundation, in relation to organisational arrangements. In the light of investigation into the technology of irrigation and its

physical structures, we shall examine the major characteristics and functions of organisational arrangements such as mu fai in Chiangmai on the one hand, and the absence of social organisation and the individualistic nature of 'flooding irrigation' in Ayutthaya on the other. In dealing with social arrangements of traditional irrigation, it will be necessary also to take into consideration the linkages with external factors, particularly with higher levels of authority such as the Royal Irrigation Department as a government agency (Leach, 1961: 45-47; Grader, 1960: 270; Hunt and Hunt, 1976: 292-294). The closed, independent and self-regulating characteristics of mu fai will be emphasised, while the government participation in Ayutthaya's irrigation will be examined in the context of improvements in irrigation under the Royal Irrigation Department projects.

2. Müang Fai: the Indigenous Irrigation System in Chiangmai Village

(1) Physical Structures of Müang Fai System

The müang fai system, which, as we have already discussed, is a crucially important facility in irrigated farming throughout the Intermontane Basin farming region, may be divided into three main types according to the size of irrigable area. The four müang fai systems, irrigating the four major fields in the Mae Rim valley and its tributary, are exclusively typical small-scale systems classified as 'the Valley and Alluvial Fan type' in which the size irrigable area ranges between 100 and 1,000 rai. Of these four systems, one takes water from the Mae Raem river, a western tributary of the Mae Rim river, and the other three lie across the Mae Rim river and their distribution networks along it (Figure 23).

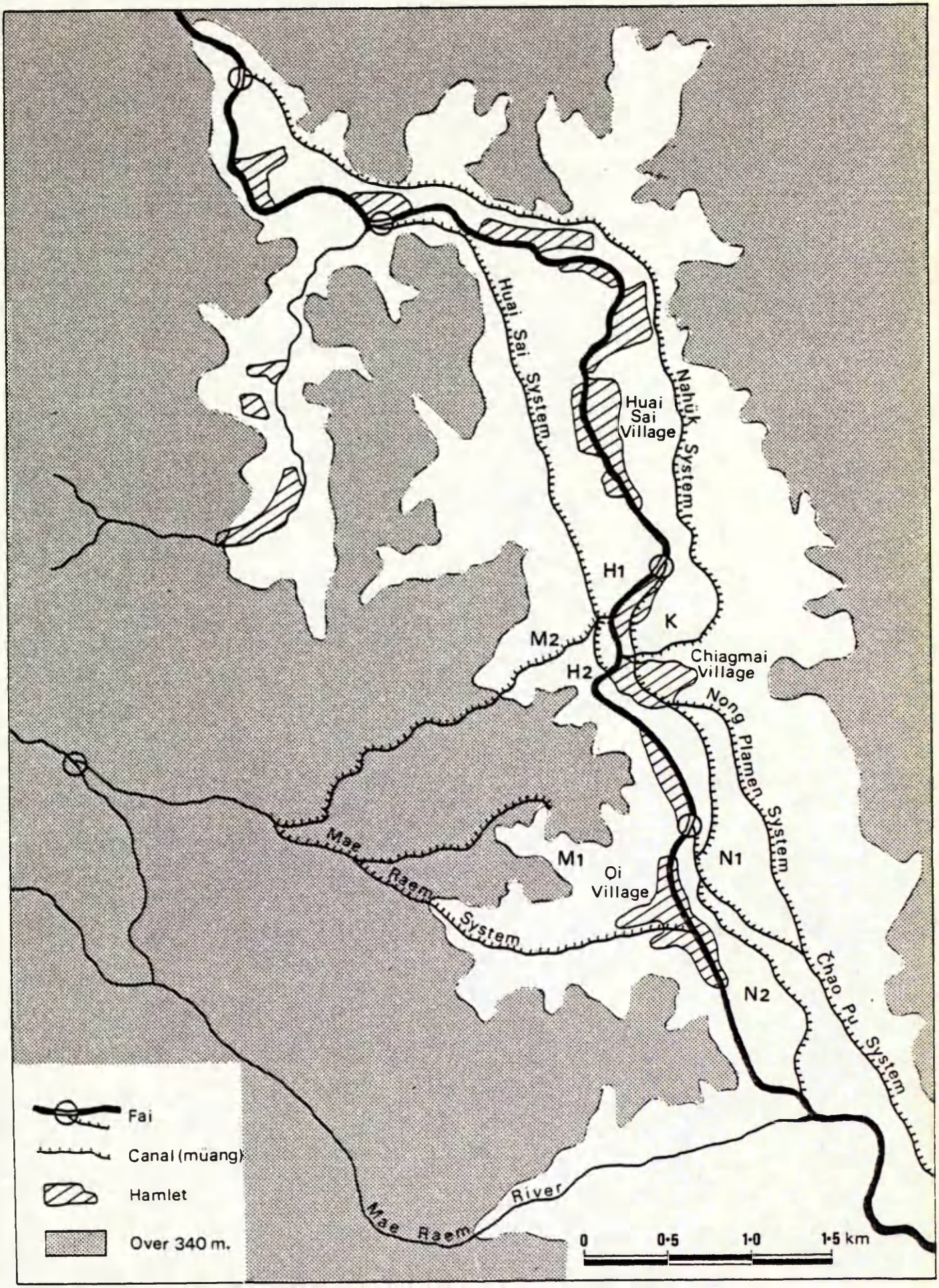


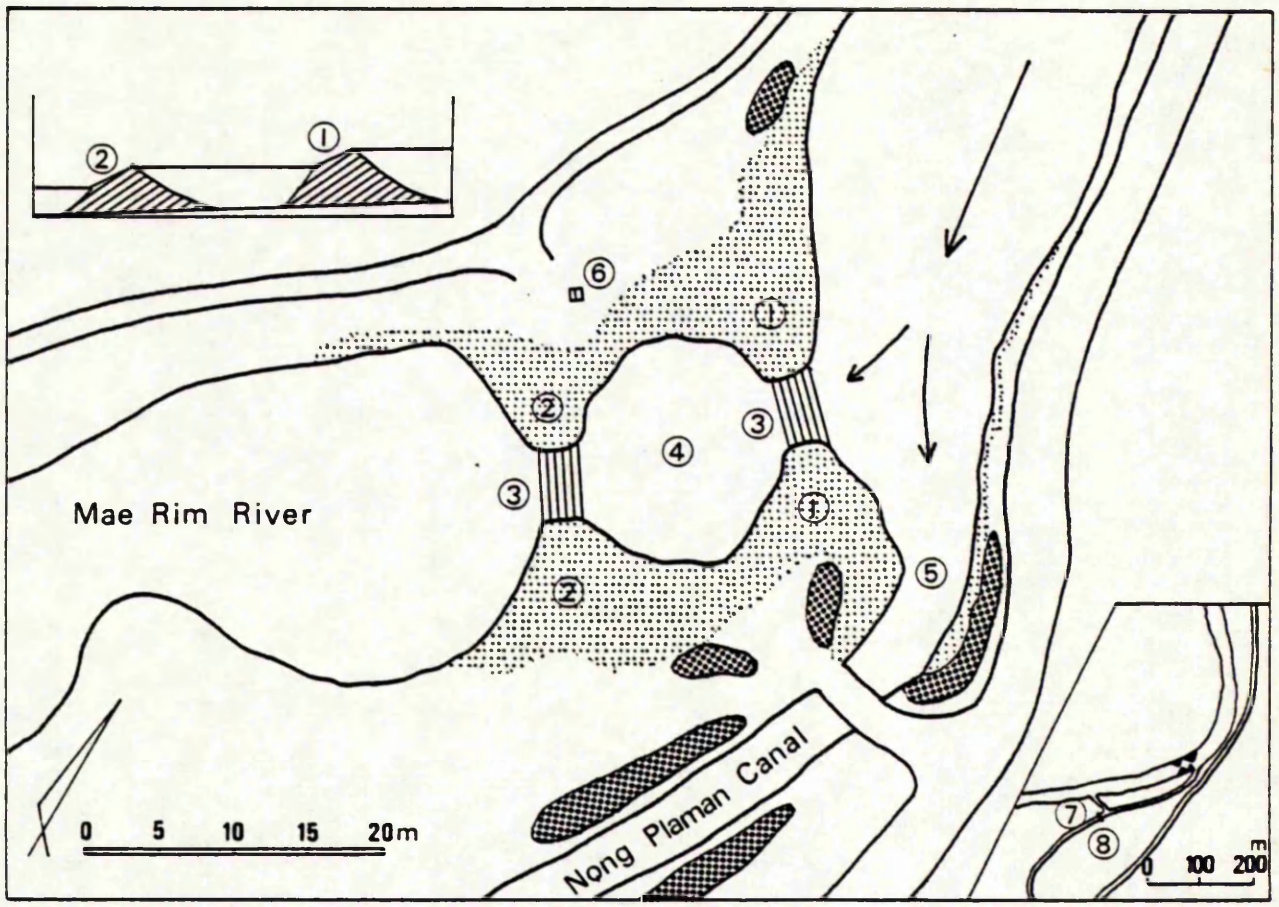
Figure 23: Müang Fai Systems in the Mae Rim Valley and Adjacent Area

The fai of the Mae Raem system, differing from the other three, is a permanent structure, which is built with stone and concrete on the bed rock to hold up a stream half the width of the weir. Its main canal runs on the hilly terrain covered by pae and flows down to the Mae Rim channel, watering the main field of Qi village to the south of Chiangmai village. In its course, it branches off at two points to irrigate M1 and M2 fields which are terraced fields opened in the 1930's and in the 1950's respectively and are worked mainly by Chiangmai villagers. The system originally aimed to irrigate the fields of Qi village and the benefit to the Chiangmai villagers' fields came later. These main and lateral canals are artificial modifications of natural small streams which dry up during the dry season.

The other three systems are called the Nahuk system, the Huai Sai system, and the Nǫng Plaman system, all of which take water from the Mae Rim river to irrigate the three main fields: the Nahuk field (N), the Huai Sai field (H1 and H2), and the Nǫng Plaman field (N1 and N2). They have the temporary structure common throughout the Intermontane Basin farming region, constructed mainly of numerous wood stakes with brushwood, rubble and earth. All three fai are installed across its full width at a bend of the river, with the canal intake (pak müang) more or less located at the concave side. Since the river current, swinging around the bend, tends towards the concave side, the water held back behind the fai is naturally directed to flow down into the main canal. The fai laid slightly aslant the river current and the main canal dug at an acute angle to the current also seem to help the natural flow into the channel.[1] All the fai have, as commonly observed in most mountain valleys of the region, a twofold structure composing of

two weir bodies constructed about 10 m away from each other, the fai at nam (main weir) upstream and the fai nun nam (supporting weir) downstream. Due to the rapid flow of the mountain streams, the fai constructed of such low-durability materials as woodstakes are quite vulnerable to rising water during the rainy season. The twofold structure of the traditional fai, therefore, seems to be an attempt on the part of indigenous engineering to absorb shocks caused by enormous quantities of swirling water carrying pebbles, large boulders and rocks during times of flood.[2]

Figure 24 shows the plan of the Nǫng Plaman fai, the most important weir from which the greater part of the area operated by Chiangmai villagers is watered. The plans of the other two fai of the Huai Sai and Nahük systems are quite similar. The main weir is constructed upstream 15 m away from the supporting weir, lying at an angle to the stream to lead the water into the intake. The foundations of both weir bodies are mainly constructed of an enormous mass of solid woodstakes called lak fai (weir stake) driven deeply into the river bed. Although the material to be used for the lak fai varies according to the area and the supplies available in the fai of Nǫng Plaman and the other two fai, it has traditionally been specific hard woods such as teak (sak) and tüng (Dipterocarpus tuberculatus), with bamboo for supplementary use. In the central part of both weir bodies is the sluice channel (tang fai) of 5 m in width, provided with the sluice-gate or tae[3] which is not movable but fixed at a certain level of water. Each tae is constructed of some ten tüng logs of 15-20 cm diameter and 6 m long, laid across the sluice channel.



Weir foundation made of wooden stakes (lak fai)

Bamboo thicket for prevention of flood

① Main weir (fai at nam)

② Supporting weir (fai nun nam)

③ Sluice channel (tang fai) and sluice-gate (tae)

④ Afterbay (khang nam)

⑤ Intake (pak müang)

⑥ Fai spirit house (ho phi haksa fai)

⑦ Spillway (müang hong nam)

⑧ Head regulator (patu nam)

Figure 24: Plan of the Fai Nong Plaman

During the dry season and the early rainy season until May, the stream only flows down the narrow sluice channel of the two weir bodies. After receiving the increasing rainfall from June onward, however, it becomes swollen and overflows the whole weir until October. During this period, various parts of the weir bodies including tae are normally subject to considerable damage, and are sometimes partly washed away particularly by the extraordinary floods caused by torrential rainfall in September and October. Such disastrous damage to the fai seems to occur once every four or five years. It should be noted, however, that destruction of the dam structure, reducing the water level in the canal, conversely helps to prevent serious damage by flood to the rice plants at the time of panicle formation. For this reason, the low durability of the traditional fai structure is not necessarily a defect of the indigenous engineering, but can be regarded as fairly well-developed design within the limits of long-established peasant technology based upon ecological considerations.

In addition to its low structural durability, the fai is provided with other facilities for flood prevention. A head regulator (patu nam), the only modern facility with a concrete and iron structure, replaced the old wooden one in the late 1960's to regulate the water level in the main canal. There is also a spillway (müang hǫng nam) linking the Mae Rim river with the main canal just in front of the head regulator, draining the excess water from the canal when it reaches above a certain level.[4] Numerous stakes driven along both banks, especially on the concave side around the intake, clearly indicate continuous works of bank protection against undercutting by the current. Planting bamboos has been traditionally regarded as an important means

of bank protection throughout the region, since the thickly developed subterranean stems of bamboo are able to reinforce a bank against erosion. Bamboo thickets planted for this purpose are found particularly around the area of the intake. The entire area of the two weir bodies and the intake, thus carefully protected, represents the most crucially important part of the müang fai system, and is customarily called hua fai (head of the weir). The hua fai is regarded as a sanctuary and is provided with a spirit house where the spirit cult of the phi fai (phi haksa fai, or the guardian spirit of the fai) is held every year, as we shall see later.

From the intake, there is a main canal or müang luang extending to the Nǫng Plaman field. The water taken at the intake, passing through the head regulator, is conveyed in the main canal from which branch several lateral canals or müang sǫi at smaller diversion weirs (tae). The lateral canals further branch off into tertiary channels, which ultimately convey the water into individual plots through farm turnouts (pak tang nam). The water distribution system is thus a branching reticulation system leading from the intake to the farm ditches. The bed of the main canal, as well as of the lateral and tertiary canals, is loam or loamy clay, as widely found on the rice fields elsewhere in the Nǫng Plaman field. There is an abundant deposition of mud and silt throughout the system. Particularly at some points of the main canal where the velocity of flow is reduced, deposition frequently causes the aggradation of the stream bed, resulting in serious obstacles to the distribution of water into the terminal networks. This causes an inevitable problem in the maintenance of the müang fai system, together with the annual destruction of the fai by floods.

Within the distribution system eight diversion weirs installed in the main and lateral canals are of importance in allocation of water into the terminal networks. These traditional diversion weirs have a simple structure made up of wood stakes with a few wooden boards across the central part as the sluice-gate. The wooden boards are movable so that an appropriate water level can be set. During the late 1960's the eight diversion weirs were all improved by substituting concrete structures for the wooden stakes, but wooden boards are still used for the sluice-gate. At the tertiary level the farmer normally draws water into his plot simply by installing a farm turnout at a fixed point according to regulations.[5] From this point onwards the technical operation and maintenance of the irrigation water is completely under his individual management. All the facilities and physical structures from the hua fai up to farm turnouts are however customarily seen as a common responsibility among the members of the mu fai.

All the four müang fai systems in the Mae Rim and the Mae Raem valleys are able to supply ample water at least during the period of main season cultivation. There is no water deficiency from the period of land preparation and nursery culture in June and July through the periods of transplanting and tillering stage in August and up to mid-September. In July and August when strong demand for irrigation water normally arises for the crucial farming operations, there is even surplus water in many parts of the tertiary system, which is drained to the system downstream or sometimes into the main channel of the river. For this reason, few problems arise over allocation of water to the members' plots during main season cultivation. Such an ample supply of water during the period is attributable to the relatively large water resources compared to the operated area, expansion

of which has been rather restricted due to the narrow alluvial valley. In addition to the environmental factor, the technical efficiency of the physical structures of the müang fai system is at its greatest under favourable conditions of water supply. In so far as the Chiangmai village economy remains at a subsistence level with great emphasis upon main season rice cultivation, it can be safely asserted that the existing müang fai systems can work efficiently to meet with the present demand for water. However, it is also true that these müang fai systems do not work efficiently in relation to fulfilling the water requirement for dry season cultivation, including early season rice and upland cropping of such crops as soybeans, tobacco and vegetables. The amount of water supplied to the system from the mountain valleys is clearly deficient for the full development of the dry season cultivation.

It can thus be said that the müang fai systems, within the framework of their indigenous technology particularly in physical structure, are primarily designed to fulfil the needs of main season rice cultivation, but not dry season cultivation. We can then identify some fundamental requirements in the maintenance of the physical system, which have been an almost essential element of these systems. First is the requirement for annual repairs to the damaged weir bodies, divided into two stages according to the land-use pattern: the primary repairs for the main season cultivation, or ti fai huapi (driving foundation stakes early in the year), to be carried out before land preparation and nursery culture in May and June; and the supplementary repairs for the dry season cultivation, or ti fai na laeng (driving foundation stakes in the dry season), to be made sometime immediately before harvesting the main season rice and in the beginning of the dry

season cultivation. Second is the requirement of annual dredging of canals, or khut lǫk müang, to dredge up mud and silt from the beds where deposition has become an obstacle to water flow. In order to maintain the carrying capacity of the canals, the annual dredging must normally follow both the primary and supplementary repairs to the weir bodies. These fundamental requirements of routine maintenance are able to be accomplished within the framework of indigenous peasant technology and have been carried out for over a century under social arrangements inherent to the peasant society. The annual repairs and dredging are really laborious and onerous tasks which could hardly be carried out without a massive input of labour and materials in a well-organised peasant group. In Chiangmai's peasant farming, then, we encounter a vital nexus between the indigenous irrigation systems and organisational arrangements, which is scarcely found in the 'flood irrigation' of Ayutthaya village.

(2) Mu Fai: the Irrigation Control Group

An irrigation control group, called mu fai (a group of the weir) or more formally mu müang fai diao kan (a group using the müang fai system in common), is principally organised by the peasant households who cultivate using the irrigation water from the same müang fai system. Although the land or river on which physical structures such as fai and müang are constructed is in most cases state-owned property, the customary use-rights of these facilities and the water rights have long been officially recognised for the members of the mu fai as People's Irrigation Projects.[6] Aside from the legal provisions, most peasants regard the müang fai system and its physical structures as their own property customarily held in common.[7] Based on such a common consciousness,

the peasant households who share the privileges and responsibilities associated with the system are organised into mu fai under a highly co-operative social norm to manage all aspects of irrigation.

Since a müang fai system, deriving water from a single fai laid upstream, distributes it downstream as far and wide as possible through canals and farm ditches, its command area is hardly confined within the territory of a single village, but normally extends over several. This naturally means that a mu fai is organised among the peasant households from the different villages encompassed by the system. Table 26 shows the four müang fai systems associated with Chiangmai village fields in relation to the area operated and number of operating households in Chiangmai village (Table 26 and Figure 23). It is clear that the Nǫng Plaman system which draws water from the fai installed at the northern end of Ban Fai hamlet is the most central to Chiangmai's main season cultivation, irrigating more than a half of the total operated area and with more than half of the operating households as members of its mu fai. The main area irrigated and most of the members of the other three systems are outside Chiangmai village
Viewed from the framework of the village community, there exist four müang fai systems, each with their mu fai members, with those of the Nǫng Plaman system in the majority. Thus, the mu fai is, in principle, organised separately from the village community.[8] However, it should be noted that every mu fai, especially in small-scale müang fai systems, has its nucleus in a specific village to which the greater part of its irrigated land belongs, as in the case of mu fai of the Nǫng Plaman system for Chiangmai village.[9]

Since the four mu fai are quite similar, we shall discuss them focusing mainly on the mu fai of the Nǫng Plaman system. Here a member

TABLE 26: Number of Operating Households and Area Operated within Four Müang Fai System in Chiangmai Village, 1974-75

Müang fai system	Total irrigated area (rai)	Area operated in Chiangmai village (rai)	No. of operating households				
			Landlord-operator	Owner-operator	Part tenant	Tenant	Total
Nọng Plaman	600.75	358.75	6	15	13	26	60
Huai Sai	c. 400.00	175.50	6	5	2	16	29
Nahuk	c. 300.00	62.50	1	3	0	4	8
Mae Raem	c. 350.00	102.00	0	7	0	9	16
Total	1,650.75	698.75	13	30	15	55	113

Source: 1974-75 Survey

TABLE 27: Composition of the Mu Fai of the Nọng Plaman System, 1974-75

Village	Main season group (mu hua pi)		Dry season group (mu na laeng)	
	No. of members	Area operated (rai)	No. of members	Area operated (rai)
Chiangmai	60	358.75	89	120.75
Ọi	15	141.00	37	47.00
Muang Pha	15	101.00	16	19.25
Total	90	600.75	142	187.00

Source: 1974-75 Survey

of the mu fai, called luk mu fai (literally, child of the mu fai), is held responsible for maintenance of the system under customary regulations in return for the privilege of receiving the water. Members are divided into two functional sub-groups according to seasonal land use with varying responsibility for repairs to the weir bodies and dredging canals, the main season group (mu hua pi or literally the early group) for the primary repairs and dredging in the rainy season and the dry season group (mu na laeng) for the supplementary works in the dry season. The former consists of the member households cultivating main season rice, while the latter comprises those cultivating upland crops such as soybeans and tobacco and, occasionally, early season wet-rice. The member households in the two sub-groups overlap considerably, since many households carry out dry season cropping, though on a quite small-scale. As shown in Table 27, the number of households in the dry season group is larger, but its operated area is smaller than that of the main season group. This is because, in addition to the main season cultivators, there is a considerable number of households who engage in upland cropping on a quite small scale of about 0.50 or 1.00 rai only during the dry season. The main season cultivators also reduce the planted area for dry season cropping to about the same size, mainly due to shortage of irrigation water. The increased numbers in the dry season group chiefly come from the rural labourers who manage to rent a tiny piece of land for upland cropping to obtain some cash during the low income period.

Membership of mu fai is not directly related to land ownership, since it basically consists of the households who actually till the land and thus draw water from the system. Membership thus stems from water rights. Therefore, on a rented holding, the tenant has both the

privileges and obligations of a luk mu fai, while the landlord has no rôle in irrigation. However, since the water rights are always bound to the land, when a landlord changes his tenant, the new tenant naturally becomes a member of the mu fai in place of the old tenant. There is no specific ritual for admission to membership of the mu fai, the new member merely making a verbal promise to conform with the customary regulations in irrigation management. There are considerable changes in the membership, particularly among tenants and rural labourers. Shortages of water and considerable fluctuations of market price make dry season cultivation rather sporadic among these tenants and rural labourers, and this leads to frequent changes in the membership of the dry season group. By contrast, however, in the main season group the member households are almost fixed, with the exception of a few changes in tenants members.

Thus, the mu fai as an organisation contains these two functional sub-groups in terms of the seasonal land use and the customary obligations to be fulfilled especially in routine maintenance of the physical system. It should be noted, however, that fundamental significance has always been laid upon main season cultivation for subsistence, and dry season cropping has only been developed on a small-scale in recent years. This is reflected by the fact that the main season group has relatively fixed members and has heavier obligations with regard to maintenance and the traditional spirit cult, as we shall see later. It is reasonable to assume that the mu fai was, indeed, originally established among the households of the main season group, with the dry season group being added later as dry season cash cropping has developed.[10]

The mu fai of the Nọng Plaman system, as commonly found in many systems of the region, has a kae müang (sometimes called huana müang fai)

or an irrigation headman, who is responsible for coordinating all activities for maintenance and operation of the irrigation system. The kae müang is elected to office by the total membership of the mu fai at the retirement or replacement of his predecessor. All the member households within the mu fai customarily have a right to vote to elect a kae müang. Although there is no limit on his tenure of office, he is customarily subject to replacement at his own request when he reaches old age or if he is voted out by the members, although this rarely happens. Since to perform the office of kae müang requires high technical skill, careful judgment of the hydrological conditions of the river and the physical irrigation system as well as leadership ability, he normally holds the office roughly between the ages of thirty-five and fifty-five and resigns before reaching an advanced age.

With respect to the office of kae müang and its role in connection with local social organisation and higher levels of authority, there seem to be many variations between systems and areas. Broadly speaking most small-scale systems of the Valley and Alluvial Fan type still remain untouched by any government agencies, while some traditional large systems of the Alluvial Plain type have been managed more or less in association with the authority of aristocracy in former days and of local administration at the present time. The latter case is typically found in the Phaya Kham system (the Tha Sala system) which was established by a local leader in 1867, and is now under the control of nai amphoe (a district officer), extending over eight tambon downstream of Chiangmai city (Suwaphot and Vanpen, 1977: 1-31). Outside the larger systems, however, the role of the kae müang appears to retain minimum links with higher levels of authority. As many studies have suggested, it is usual that elected village headmen, responsible for local administration,

do not have any place in the hierarchy of irrigation administration (de Young, 1958: 78-79; Wijeyewardene, 1965: 258-259; Wijeyewardene, 1973: 104; Abha and Nisa, 1974: 94-95). In the case of a system in Chiangkham, Chiangrai province, the office of irrigation headman has been assigned to elderly villagers who were fairly prosperous but had little political influence (Moerman, 1968: 51). Conversely, however, we can also frequently find examples where the role of kae müang is related to the village administration, as was the case in Ku Daeng village of Saraphi district, Chiangmai province (Kingshill, 1976: 116-118).

In the case of the mu fai of Nọng Plaman, we can identify the officeholders of kae müang dating back to the 1920's, when Khun Saisarakit (Inta Sidwangkaeo) exercised his political power as pọ khwaen over the seven villages in the Mae Rim valley. As shown in Table 28, most officeholders were simultaneously appointed as pọ khwaen (head of a khwaen, now tambon) or pọ luang (village headman). The period in office of the first four kae müang ranged between nine and twenty years and they resigned around the age of fifty-five. All were residents of Chiangmai village and successful landlords or owner-operators owning relatively large holdings. Since the greater part of the command area of the system belongs to Chiangmai village, the kae müang has been selected from among the residents of the village throughout history. This is because such a person represents the benefit of the majority of members and also because he is able to devote greater attention to the operation and maintenance of the physical system.

In the command area of the system, all cultivable land had been reclaimed by the period of Khun Saisarakit. According to the testimony of some old villagers, however, before that period the officeholders

TABLE 28: Kae Müang of the Mu Fai of the Nǫng Plaman System, 1921-1975

Name	Political status	Land tenure status	Area owned (rai)	Period in office (year)
Khun Saisarakit	pǫ khwaen	Landlord	78-100	1921-1940 (20)
Nai Yasi Thakham	pǫ khwaen	Landlord	24	1940-1950 (11)
Nai Thon Khongdon	pǫ luang	Owner-operator	15	1950-1962 (13)
Nai Pan Suttharat	pǫ luang	Owner-operator	12	1962-1970 (9)
Nai Thǫngrian Siduangkaeo	Assistant pǫ luang	(Tenant)	(10)	1970-

Source: 1974-75 Survey

TABLE 29: Farm Turnout Fee, Spirit Cult Fee, and Upland Cropping Fee in Four Mu Fai, 1974-75

Mu Fai	Main season group		Dry season group
	Farm turnout fee (litre of paddy per rai)	Spirit cult fee (baht per household)	Upland cropping fee (baht per rai)
Nǫng Plaman	3	2	1
Huai Sai	10	2	2
Nahuk	5	2	3-5*
Mae Raem	8	2	10

* 3 baht per 1,000 seedlings for tobacco cultivation, and 5 baht per household for soy-bean cultivation

Source: 1974-75 Survey

were able to take advantage of their position by reclaiming land and extending lateral canals and farm ditches through the manipulation of the customary regulations for labour mobilisation. The present kae müang holds one of the two posts of assistant pǫ luang (officially called in Siamese, phuchuai phuyai ban or deputy headman) in village administration, though he still has the status of tenant at present. He is, however, actually a potential landlord or owner-operator, being a son of the largest landlord in the village and a grandson of Khun Saisarakit, with the full expectation that he will be able to inherit more than 10 rai of his father's holdings. He can no longer take advantage of his position in expansion of his holdings, but his position as assistant pǫ luang ensures him great influence in village administration. Thus, the office of kae müang seems to be closely related to the distribution of political power within the local area, particularly in the core village in which the greater part of irrigated land is located. Such a tendency is common among other mu fai of the Mae Rim valley.

The roles of kae müang are primarily to organise the major tasks involved in operation and maintenance of the physical system of irrigation. These tasks are: (1) the allocation of water to the members' plots and resolution of conflict among the members of the mu fai and between mu fai; (2) routine maintenance of the physical structures, i.e. repairs to weir bodies and dredging canals; and (3) organisation of the spirit cult relating to the guardian spirit or phi haksa fai. In order to organise these major tasks, the kae müang is required to undertake routine duties throughout the year: he has to make regular inspections of the physical structures from the fai and intake up to the tertiary canal networks; when he discovers misuse of the

system, he launches investigations and levies a fine on the offender; he maintains banchi mu fai or the record of mu fai concerning each member's operated area and other relevant matters concerning maintenance and operation.

For the purposes of everyday inspections, particularly of the crucial facilities in the area of hua fai and of operation of the head regulator, an irrigation watchman called pǫ fai (literally, father of the fai) assists the kae müang. The pǫ fai must be the resident living closest to the hua fai so as to carry out his duties of everyday inspection and prompt operation of the head regulator whenever necessary. The pǫ fai is not necessarily a member of the mu fai and is a hereditary office, at least in the case of the mu fai of the Nǫng Plaman system. Another important role of the pǫ fai is to perform the spirit cult by invoking the phi fai after the annual repairs to the fai. This indicates the pǫ fai's magical association with the land on which the crucial facilities are located and contrasts with the secular authority of the kae müang.

For the services of the kae müang and pǫ fai in operation and maintenance of the system throughout the year, a reasonable compensation is made in various ways by the member households of the mu fai. In making repairs to the fai and in the work of dredging canals the kae müang is entitled to total exemption from the supply of materials and necessary equipment for these works, which is obligatory for every other member under the customary regulations. The pǫ fai is not a member household receiving water rights, so naturally he is also exempted from such obligations. In addition to this, a substantial payment both in kind and cash is made by the member households to the kae müang and pǫ fai. Table 29 shows the various kinds of payment to these offices

required by the four mu fai in the Mae Rim valley and adjacent area. There are three kinds of payment which should be made by every member in terms of the fixed rate in each mu fai.

For the main season group there are the farm turnout fee (kha tang nam) and the spirit cult fee (kha liang phi fai). The farm turnout fee relates to the member's right to install a farm turnout (pak tang nam) to draw the irrigation water. It is levied on the area operated and is paid by paddy after harvest. The rate of the farm turnout fee varies between the mu fai according to the command area and amount of work to be done by kae müang and pǫ fai. In the case of the Nǫng Plaman system, the kae müang initially collects 3 litres of paddy per rai from all the members after harvest, amounting to about 90 thang (1,800 litres) in total,[11] of which 40 thang are paid as compensation to the pǫ fai and the rest (50 thang) are received by the kae müang. Another fee to be paid by the main season group is the spirit cult fee which is collected by the kae müang from all the members in cash and is delivered to the pǫ fai for his expenses in the performance of the spirit cult. The spirit cult fee is basically paid not in reward for the services of the offices but for the expenses involved in the ritual and the subsequent feast enjoyed by the members. For the dry season group, on the other hand, there is no ritual fee but only the upland cropping fee (kha hua suan) paid only to the kae müang in cash. It is principally levied on the operated area, but the conditions of payment vary between mu fai. Particularly in the mu fai of the Mae Raem system, the water for upland cropping is available only in a limited area of the M1 field due to the water scarcity in the system during the dry season, and therefore the upland cropping fee is quite high. Be that as it may, these differences in payment of the various fees to the officeholders seem to reflect the

fundamental characteristics of the two functional sub-groups, i.e. the traditional main season group in subsistence production and the additional dry season group in supplementary cash cropping.

In the course of the above discussion, we have described the major organisational characteristics of the mu fai, focusing mainly upon the membership, functional sub-groups and the roles of kae müang and pǫ fai. It is obvious that Chiangmai village's indigenous irrigation systems, fundamentally designed and constructed by concentration of peasant technology, have been able to work efficiently only through the organisational arrangements of the mu fai. Now, we turn to examine how the system is operated and maintained within the framework of the mu fai and its customary regulations, by investigating allocation of water rights, annual maintenance, and organisation of the spirit cult.

(3) Operation and Maintenance of the Müang Fai System

(a) The Allocation of Water and Conflict Management

Generally speaking in wet-rice cultivation, the possibility of a shortage or excess of water is basically dependent on the relationship between supply and demand for water in a given cultivation method at a certain period. In Ayutthaya village of the delta, the large-scale annual flooding beginning from late August onwards might give a general impression of excess of water, but this does not mean at all that a sufficient water supply is available for cultivation by transplanting. In Chiangmai's main season transplanting culture, a shortage or excess is of great significance, particularly in the vegetative growth period from sowing to the tillering stage, or in the period from nursery culture and land preparation up to a few weeks after transplanting.

Successful irrigation in main season cultivation totally depends on its management during this relatively short period lasting from May to August. As we have indicated, in the Nǫng Plaman system, the water supply from the Mae Rim river is, in normal years, sufficient to meet the demand in the command area amounting to around 600 rai, in so far as the present physical system works efficiently. It should be noted, however, that a situation of water scarcity in which demand is significantly greater than supply occurs even in the main season once every five years. For dry season cropping the water supply of the river is so reduced that it allows the cultivation of only 150 rai, only a quarter of the total command area in the main season. In relation to balance between supply and demand in the Nǫng Plaman system, thus, it may be summarised that there is a water shortage for main season cultivation, the essential base of peasant subsistence, in accordance with the yearly fluctuation of water supply from the river, and a major water shortage in relation to the full development of cash cropping during the dry season.

The yearly fluctuation of the water supply from the river in the wet season is an accepted fact among the peasants. We have seen already some of the uncertainties of the system. In addition to the damage expected annually, the physical structures are exposed to complete destruction by an extraordinarily high flood, which can cause an extended period of reconstruction before full operation of the system can be restored. The entire physical system of the müang fai has traditionally been operated under such uncertainty and all the peasants who are members of the mu fai are well aware that the water is a limited resource which can become available as a means of production only through the artificial structures which they must constantly maintain. For these

peasants, the irrigation water called nam müang (canal water) is clearly distinguished from such natural water supplies as rainfall and river water and accordingly is quite different from the nam thuam (flooding, or flood water) affecting Ayutthaya's peasants. Water allocation thus has become one of the major aspects of irrigation management.

In the mu fai of the Nǫng Plaman system water allocation means the allocation of water rights or sit chai nam (use-rights of the water) which belong to the mu fai. Every member household has the right to a proportion of the water, which is distributed by each household installing a farm turnout (pak tang nam) across the dike to draw the water into his plot. In return for this right he has the responsibility to supply labour, materials, necessary equipment and other resources required in operation and maintenance of the system. The allocation of water rights within the mu fai is principally based on proportionality. As commonly found in many examples of traditional irrigation systems,[12] the proportional allocation of water rights is a principle to which every member must adhere under conditions of water scarcity.

Broadly speaking, there are normally three possible kinds of arrangement in the proportional allocation of water rights. First, we have the arrangement of landholdings which renders all members' holdings equally accessible to the water resource. This arrangement may be made in various ways such as redistribution of members' holdings in different portions of the command area so as to allow a proportional reduction of water supply to all members in times of water shortage. Such arrangements are practised in systems of greater water scarcity under the specific socio-economic conditions whereby land holdings are regularly redistributed and under strict co-operative regulations, as described in Sri

Lanka and the Ilocos Coast of the Luzon (Leach, 1961: 160-165; Coward, 1979: 30-31). A second method is a time-based rotation which makes a strict proportional allocation of the scarce water through measuring the allotment of water flow into members' plots or parcels by time. This type of strict arrangement is often practised where there is a greater degree of water scarcity such as in some areas of the early modern Japan and of many arid countries (Kitamura, 1971: 322-346; Smith, 1959: 218; Glick, 1970: 207-216, 230). A third possibility is the control of farm turnout equipment and diversion weir through the regulation of the size of the turnout. Such a control for proportional distribution is popular in most traditional systems all over the world and is widespread in the Intermontane Basin farming region of Thailand and the adjacent regions (Kitamura, 1971: 346-352; Leach, 1961: 160-165; Chen, 1949: 42; Abha and Nisa, 1974: 94). It is sometimes observed that these arrangements are applied separately, but more often a combination of methods is utilised.

Out of these arrangements for water allocation, the mu fai of the Nong Plaman system, together with other mu fai in the Mae Rim valley and adjacent area, has long adopted only the third one, for both its main season and dry season groups. This seems to be related to the relatively adequate supply of water from the river, so that arrangements for tighter control have not evolved. The control in the mu fai is essentially made at the farm turnout for each individual plot, so that the key point for the distribution of water is at the contact point between the public portion and the individual part of the system. However, an appropriate allocation is needed for the public portion of the system in order to achieve the required distributional arrangements at the individual plot level.

All aspects of the water allocation in the public portion of the system are under the control of kae müang. He is invested with full authority to operate the water allocation by regulating the head regulator and the diversion weirs installed in the main and lateral canals. The head regulator is actually operated under instructions from the kae müang by the pǫ fai who keeps his regular watch over the area of hua fai and the regulator. After completion of the first repairs to the fai and dredging of the canals by the main season group in late May, the sluice-gate of the head regulator is fully opened to allow the flow of water into every member's plot,with the level of water in individual plots being regulated at each farm turnout. By late August the monsoon rainfall has brought a steady increase in the rate of stream flow,so that controlling the flow into the main canal by regulating the sluice-gate becomes necessary to prevent the young plants just transplanted from being drowned out. By September and October, the threat of dangerous flooding caused by torrential rainfall means that the sluice-gate must frequently be shut completely and excess water directed through the spillway (müang hǫng nam) into the river. During the critical period, since prompt operation is highly necessary in response to the changing level of water, the pǫ fai is in constant touch with the kae müang who takes charge of regulating the sluice-gate. About thirty days after flowering, or approximately late November in every year, the sluice-gate is completely shut down to drain the water off from the fields and subsequently harvesting starts. After completion of the main season cultivation in early January, the water supply begins again and continues up to early April for the dry season group members' plots.

Distribution of the water into lateral canals and terminal networks of farm ditches is carried out by regulating eight diversion weirs. As shown in Figure 25, two main lateral canals branch off the main canal at two main diversion weirs: the western lateral canal runs on the natural levee of the Mae Rim river; the eastern lateral canal goes round the foot of the hills to the east; the main channel runs through the central part of the N1 field and, after joining the western lateral, crosses over the Chao Pu main canal, which irrigates further downstream, to supply water to the N2 field to the south. The amount of the flow in these canals is primarily regulated by adjusting the sluice boards, which is carried out by the kae müang after discussion with the members in each sub-group after the annual repairs to the fai with regard to the water supply conditions in their own plots during the previous year. With the well-developed terminal networks of farm ditches, the further distribution of the water to individual farm turnouts seems to be carried out fairly well on the whole. Unless networks of farm ditches are developed, an effective distribution of the water in lateral canals to individual plots may be impossible. It can thus be said that the entire distribution system is currently capable of achieving proper water allocation to the terminal level both technically and organisationally.

Under the customary regulations of the mu fai, a member's plot often consisting of several parcels or pan na, is allowed to take water only from one or more farm turnouts installed at fixed points on canals and ditches. The farm turnout for a member of the main season group is traditionally made of a wooden conduit of semicircular cross-section of one sǫk (about 50 cm) diameter.[13] In some cases, however, the conduit can temporarily be substituted by an earth channel of the same

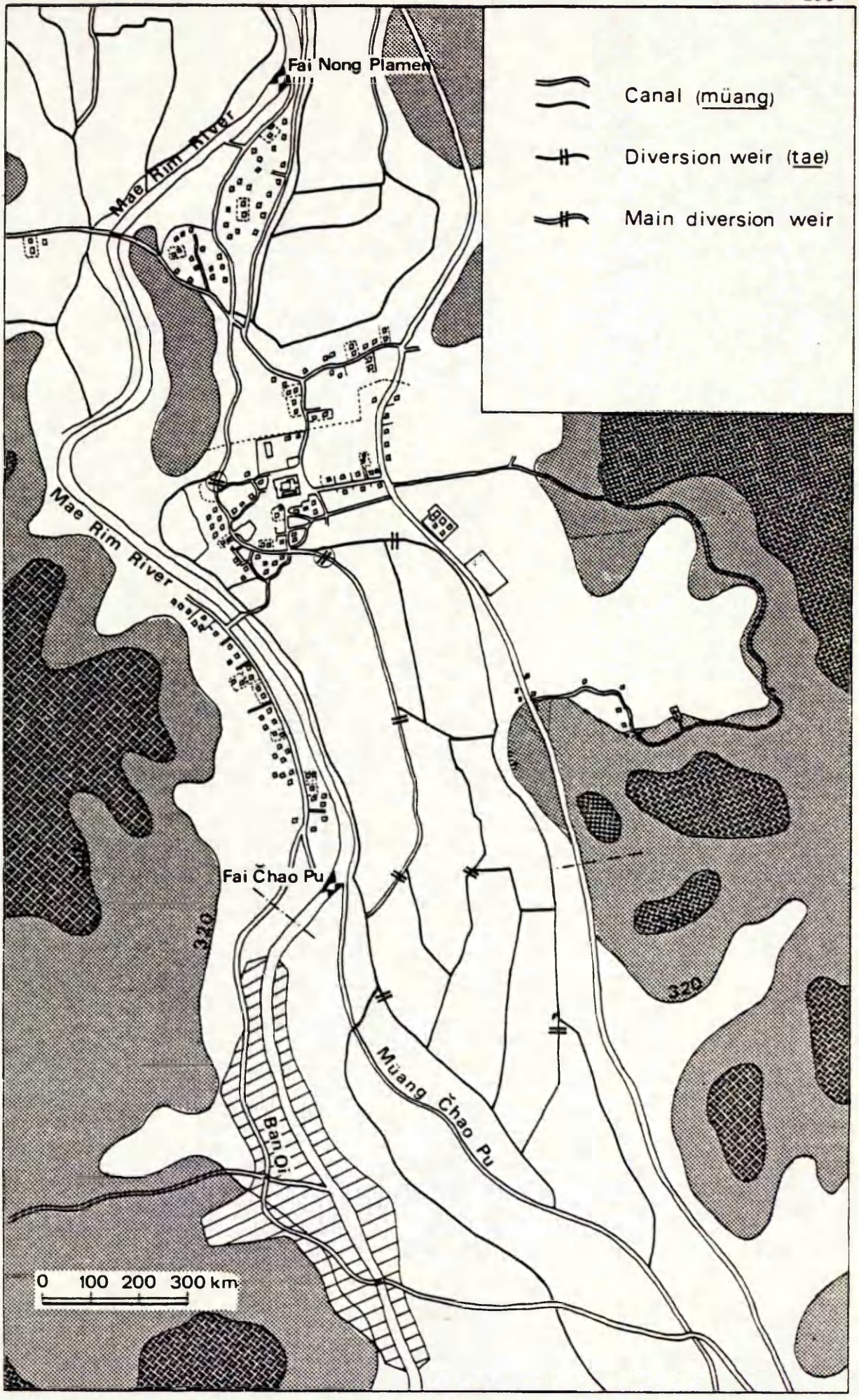


Figure 25: Plan of the Nọng Plaman System

width simply cut across the dike on the condition that it will be replaced by regular equipment. Regulations for the dry season group are tighter than for the wet season due to more serious water scarcity and only a conduit made of a bamboo tube of only 4 inches (4 niufut or about 10 cm) diameter is allowed. These regulations for the size of farm turnout are basically an attempt to fix the rate of flow into the plot.[14] In order to ensure that all the members' plots are able to receive their proportional share of the water supply, each is allowed to set farm turnouts according to his area operated. For the main season group, a member operating a single plot of up to 3 rai is restricted to the installation of a single farm turnout. However, if his operating parcels are scattered across different blocks, he may set other farm turnouts as appropriate.[15] A member household operating more than 3 rai is allowed to set more than one farm turnout in proportion to the size of area operated; thus if one has a plot of 4, 5 or 6 rai, two turnouts of the same size may normally be allowed.

A typical layout of farm turnouts in relation to each plot is demonstrated in Figure 26, showing the main season group in the northern part of the system. Every farm turnout is laid on the upstream side of the plot it serves, to facilitate the inflow into the plot. On the other hand, outlets may be provided to drain off the water into a ditch or canal at any point downstream simply by cutting the earth across the dike when it becomes necessary. Although the numbers and places of farm turnout are fixed, installing a new farm turnout and changing its place can be done by permission of the kae müang. The latter's decision depends on such considerations as changes in the supply conditions in the whole system and particularly in the adjacent plots. However, new installations which increase the demand for water

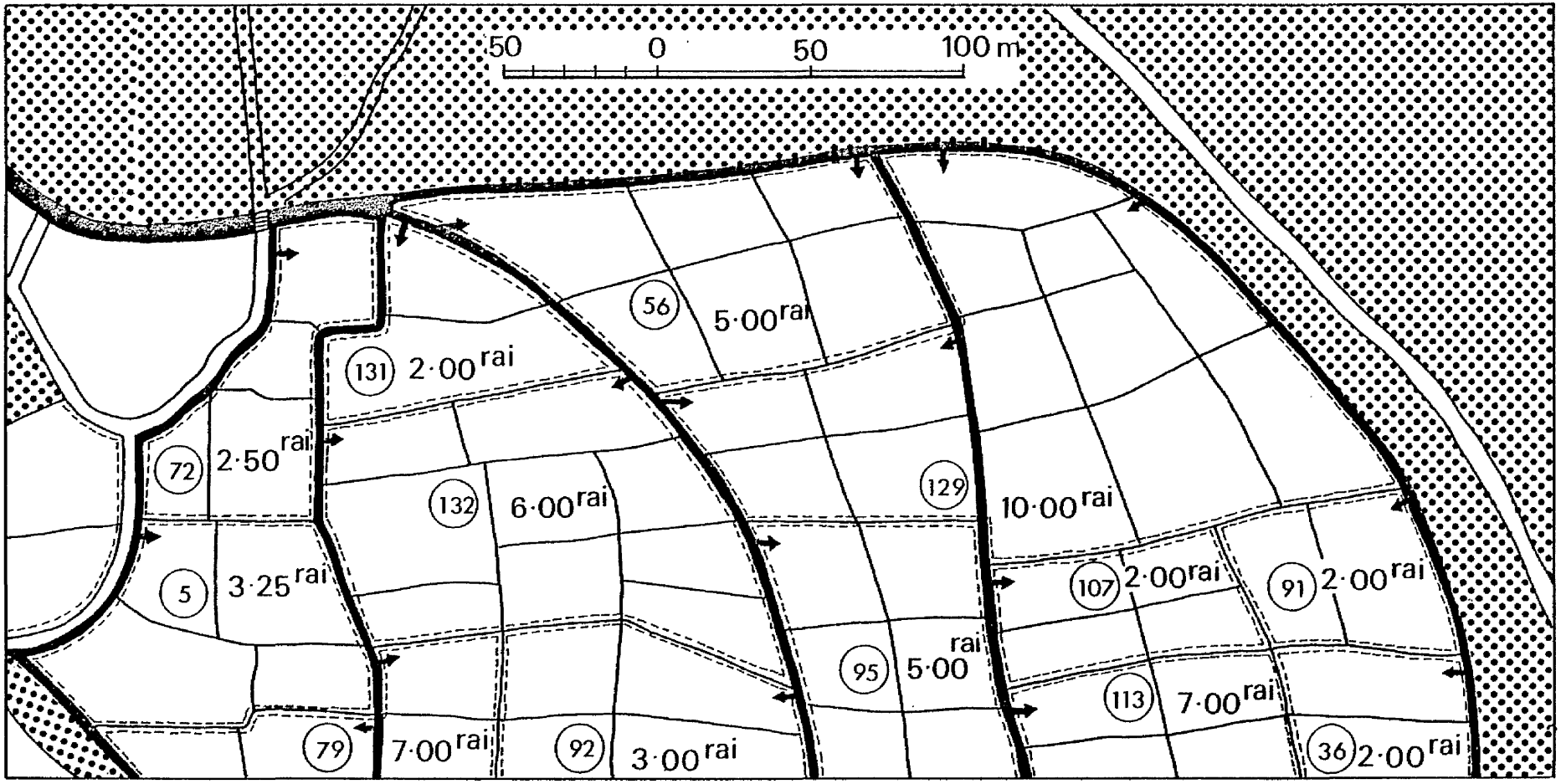


Figure 26: Layout of Farm Turnouts in the Northern Part of the Nong Plaman System

have rarely been made since the possibility of reclamation in the command area of the system ceased to exist in the 1930's.[16] Most cases of changes made during the past few decades were associated with subdivision of landownership by inheritance and an increased number of tenants in a single plot which was previously cultivated by a single tenant. Since this means that the existing share of water has been subdivided, there has been no change in the total demand for water. For this reason, new installations and changes in location of farm turnouts in recent years obviously have had no serious effect on overall conditions of water allocation in the system, at least during the main season of rice cultivation.

The allocation of water rights is basically concerned with the public portion of the system up to the farm turnout and the share of water supply within an individual plot is left entirely in the member's hands. In an individual plot the water distribution between pan na or parcels is normally made through bamboo conduits called thǫ nam buried in the dike (khan na). The thǫ nam is a bamboo tube about 50 cm long and 10 cm diameter, traditionally made of a big bamboo called mai sang (Dendrocalamus strictus). During land preparation, however, distribution of water is made simply by cutting the dikes to distribute water as quickly as possible to all pan na. The bamboo thǫ nam is widely used to keep a regular level of water during and after transplanting. In order to maintain the required level of water at various stages of plant growth, the depth of the thǫ nam is changed. From September onwards in normal years, the level of standing water in every pan na is raised through increasing precipitation to overflow the dikes. Especially in late September and early October, interfield flow between parcels and

plots is commonly observed throughout the system. Supplementary water supply from the canals and ditches is no longer necessary and conversely drainage often becomes the main concern of the peasants.

The allocation of water rights requires all member households to conform strictly with the customary regulations of mu fai (hitkǫng mu fai). While the allocation of water attempts to give fair shares to the members as far as possible, offences and violation of the regulations are almost inevitable under uncertainty and scarcity of water supply. The mu fai of the Nǫng Plaman system, in common with other mu fai, has its problems of violation of the regulations, including water theft and disputes among members, although these are rarely of a serious nature. The kae müang who is responsible for water allocation also holds full authority to deal with violations and disputes within mu fai.

Water theft, generally called lak nam, has traditionally been regarded as one of the most serious offences against public order in every mu fai of the region. In recognition that the entire physical system and water rights are owned in common, the theft of irrigation water from public portions of the system, which is specifically called lak nam müang (theft of the water in the canal), has deserved severe punishment. Thus, before introduction of Siamese provincial administration at the turn of this century, the customary laws prevailing in the Lannathai kingdom under various titles such as Mangraiwinichai and Mangraisat even decreed capital punishment for repeated water theft.[17]

In the present mu fai of the Nǫng Plaman system, in a practical sense lak nam müang now generally refers to an offence in which a

non-member household makes free with water in canals without providing any labour, construction materials and other necessary resources for maintenance of the physical system. In the Nǫng Plaman mu fai a water theft in this sense has not happened at all during the past few decades and had rarely happened even before. This is partly because almost all the member households are fixed, especially in the main season group, and there has been no non-member's plot within the system for quite a long period, and partly because the substantial obligations in maintaining the system such as repairs to the fai must be fulfilled promptly by the members of either sub-group before starting their cultivation. Thus, the kae müang and all the members are always aware in advance of who is going to use the water in all existing plots for the coming cropping season. As a consequence, social cohesion enhanced through the co-operative maintenance activities seems to guard against the offence of lak nam müang. It is also true, however, that the relative adequacy of water supply for the entire command area in normal years and physical efficiency of the system have certainly contributed to preventing water theft.

The other meaning of lak nam is the theft of water from other member's plots. This kind of water theft is committed when one member draws water illegally from a neighbouring member's plots by cutting the dikes, the occurrence of which often leads to disputes between them. Another kind of violation which has happened is the misuse of equipment, particularly of farm turnouts, to draw more water than the allowance fixed by the kae müang's specifications. Illegal modification of wooden or bamboo conduits and the installation of more farm turnouts than the number permitted constitute such infringements of the customary regulations. During the past quarter of a century (1950-1974) these two kinds of

violation have occurred but only infrequently : there were only three cases associated with water theft and related disputes and only five cases of misuse of farm turnouts. It should be noted, moreover, that all these violations happened during drought years in the lower reaches of the system which naturally suffered more severe water scarcity than other areas upstream.

In all cases of water theft and the related disputes, the kae müang settled them by arbitration after making on the spot investigations. In arbitration of the disputes kae müang levied a fine on the guilty party to the amount of the damage. In most cases the guilty party had to pay to the victim reparations both for the loss of water and for the damage to the harvest caused by the water theft. The former is assessed on the basis of the guilty party's operated area at the rate of one thang of paddy per rai, while the latter is paid by paddy after harvesting to make up for the actual loss of harvest estimated from the amount of harvest expected in normal years. In the case of misuse of farm turnouts the kae müang fines the offender, assigning the fine to the maintenance of the physical irrigation system. The offender traditionally incurred a fine at the rate of one thang of paddy per rai of his operated area for which he illegally drew water, but in recent years this has come to be paid in cash at the rate of 10 baht per rai.[18] Although the kae müang is unable to measure precisely the quantity of water stolen or illegally used, the assessment seems to be based on a principle in relation to the labour requirement for the physical maintenance of the system. The underlying calculation in the assessment is that the water needed to fill one rai of rice field, whether legally or illegally drawn, is worth one thang of paddy, which has long been regarded as an

equivalent to one man-day of labour. As we shall see in the next section, one man-day of labour is calculated as the labour necessary to prepare 30 small stakes for reconstruction of the fai, which is also the labour input required for the water supply for one rai of rice field.

In any case, in the Nǫng Plaman mu fai there have been only a few cases of violation and of dispute, almost entirely restricted to years of water scarcity. All the cases which occurred were successfully settled by the kae müang under the customary regulations and no case was taken to arbitration or judgment at higher levels outside the mu fai. This indicates that the resolution of internal conflicts is generally made independently within the mu fai with little influence from the outer world. Such independence in conflict resolution, as well as in other aspects of management, is common in many mu fai of small-scale systems, at least in the Mae Rim valley and adjacent area.[19] The highly co-operative social norm of the customary regulations (hitkǫng mu fai) and the strong social cohesion among the members seem to help to preserve the traditional order in the allocation of water rights. The social norm emphasising the common right to water as a scarce resource and its proportional allocation to the members has long acted as a deterrent to any trouble concerning water allocation. In the cases of violation and dispute mentioned above, the amount of fine levied is in fact not very heavy.[20] In addition to the fine, however, the offender loses face (sia na) among the mu fai members. Accusation of water theft or misuse brought against an offender ultimately leads to loss of face, which is the most dreadful humiliation in the context of peasant social life.

(b) Maintenance of the Physical System: Annual Repairs to Weir Bodies and Dredging Canals

The main responsibility of the members of the mu fai who receive water is to provide labour, construction materials, necessary resources and equipment required in making repairs to the weir bodies and in dredging the canals. In the same way as the allocation of water rights is organised in proportion to area planted, so the obligations required in these construction works fall upon the member households in the same proportion.[21] Since the degree of damage to the fai and canals caused by flood varies year to year, the necessary amount of labour and material input in annual maintenance varies accordingly. Reflecting differences in period of land use and in the function of the fai, obligations, especially in provision of construction materials,also vary between the main season and dry season groups.

In ordinary years, except the years of serious damage by extraordinary flood, the main season group has to carry out repairs to the fai twice, in mid-May and June, and dredge the canals once between the two routine repairs. The first repairs must be finished at the latest immediately before commencing nursery culture and land preparation, and are followed by the dredging and the second repairs. For the dry season group, the first repairs are made immediately after draining out the water from the fields and canals for harvesting the main season rice in late November. This is normally followed by a dredging in January and the second repairs to the fai in early February when a constant water supply becomes necessary for cultivation of soybeans and the early season rice. These routine works in maintenance are common in all the müang fai systems in the Mae Rim

valley, except in the Mae Raem system which needs only canal dredging because its fai is a permanent structure made of concrete.

All these construction and dredging works are normally carried out within six days as long as damage to the fai and deposition of mud and silt are moderate; two man-days of labour is requested from each member household in the main repairs, the second repairs, and in canal dredging. In these works of the whole mu fai every member household is obliged to provide such labour regardless of his operating area. Thus, the obligation to supply labour is not assigned proportionally to the area operated by member households; despite the fact that an owner-operator operating 10 rai and a tenant operating 2 rai receive different volumes of water, both have the same obligation in labour supply. Such inequality with reference to the ideal principle of proportionality in obligation is also seen in supply of necessary tools for the works. Since every member participating in construction and dredging works is obliged to take certain tools with him such as a mallet (khǫn na wen), field knife (mit), and hoe (khǫbok) etc., there is naturally a lack of proportionality in the supply of tools. Thus despite the general principle, members with larger operating areas are actually at an advantage. However, it should be noted that a substantial burden is placed on each member household by the need to supply construction materials, apart from supply of labour and tools. Particularly for the members of the main season group, in addition to the standard six man-days of labour in the construction and dredging works, they have to devote much labour to the preparation of construction materials, which, by contrast, are strictly assigned proportionally in relation to areas operated.

In the annual repairs to the fai by the main season group, the lak fai (weir stakes) to be driven in to solidify the foundation of the weir bodies are the main construction material. Although the lak fai traditionally were made of hard wood such as teak (sak) and tüng, the former, being highly valuable for construction and handicrafts, has become increasingly scarce in the area along the Mae Rim valley in the past few decades. In recent years, therefore, the lak fai have been made mainly of tüng, which can still be obtained easily in the pae or dry deciduous dipterocarp forest surrounding the valley. Every member household has to make two kinds of lak fai according to standard sizes which are the same in three mu fai: lak yai or large stakes, measuring 3 sǫk (1.5 m) in length and 4 niu (10 cm) in diameter, and lak lek or small stakes, measuring 2 sǫk (1.0 m) and 3 niu (7.5 cm) respectively. Both kinds of lak fai must be sharpened at one end to be driven into the earth. A relatively small number of lak yai are driven in for protection of the sluice-gate in both main and supporting weirs and of the area around the intake. A quite large number of lak lek are used to reinforce the foundation of the two weir bodies.

The number of lak fai required from each of the main season group members is allocated basically proportional to the area each operates and is decided by the kae müang according to his judgment of the degree of damage to the weir. The supply requirement is of course variable between mu fai and between years. Table 30 shows the assignment in three mu fai in 1975, a quite normal year. In the case of the Nǫng Plaman's mu fai, the total numbers of lak fai required for the two repairs from all the members of the main season group amounted to 780 stakes of lak yai and 24,000 stakes of lak lek.[22] Surprisingly, such an enormous number of lak fai is required for making only two

TABLE 30: Assignment of Labour and Construction Materials in the Main Season Groups of Three Mu Fai, 1974-75

Mu fai	Labour (man-day/ household)	Construction Materials			
		Main repairs lak yai*	(no./rai) lak lek**	Second repairs lak yai*	(no./rai) lak lek**
Nọng Plaman	4	1	30	2***	10
Huai Sai	4	1	30	2	10
Nahük	4	2	40	2	20

* Large stake made of tüng (Dipterocarpus tuberculatus) or teak (Tectona grandis).
** Small stake made of tüng or teak.
*** 2 stakes per household.

Source: 1974-75 Survey.

TABLE 31: Assignment of Labour and Construction Materials in the Dry Season Groups of Three Mu Fai, 1974-75

Mu fai	Labour (man-day/ household)	Construction Materials			
		Main repairs lak yai*	(no./rai) lak sae**	Second repairs lak yai*	(no./rai) lak sae**
Nọng Plaman	4	1	40	2	20
Huai Sai	4	4	20	4	10
Nahuk	4	1	20	2	10

* Large stake made of tüng or teak.
** Half split bamboo stake made of phai luak (phai ruak in Siamese, Thyrsostachys siamensis).

Source: 1974-75 Survey.

repairs in a normal year. One must note that more than two or three times this number are required after an extraordinary flood which occurs about once every five years. In the three mu fai, the first main season repairs always need more lak fai than the second repairs. This is because every member household needs to finish the greater part of the construction work when the water level of the river is still low before commencing cultivation. The second repairs are essentially supplementary, to be carried out usually as the water level is gradually rising in mid-June.

The preparation of lak fai for the main season repairs begins in the western pai, as soon as the kae müang tells each member his assignment in late April, when the traditional rituals associated with wan sangkhanlǫng (New Year's Day) and subsequent festivities are completely finished. The stakes are cut with a big field knife (mit) from tüng or teak logs which have previously been felled and seasoned. The work is normally done only by domestic labour, usually one or two people, from each member's household, but some rich households hire labourers on a piece-work basis, at a rate of 10 baht for 30 stakes in 1975. A man can normally make about 30 stakes a day, whether lak yai or lak lek, so that it can be seen from Table 30 that 1.5 man-days of labour is needed in lak fai making for one rai of operated area in the Nǫng Plaman's mu fai, i.e. a member household operating 6 rai requires about 9 man-days' labour. Thus most member households spend at least a few days and up to two weeks in preparation of lak fai in late April and early May, depending on their area operated.

On the other hand, repairs for the dry season group are made on a smaller scale, and consequently regulations for supply of construction materials are different from those of the main season group. The dry

season irrigation is designed for a smaller area to utilise the reduced supply of water resource available in the river during the season. Therefore, between the four mu fai along the Mae Rim valley, i.e. three mu fai associated with Chiangmai villagers and the mu fai of the Chao Pu system downstream, there has been a long-established mutual agreement for self-regulation of the water resource in the river, to avoid disputes between them. Regulation of the amount of water to be taken in each müang fai system is achieved by a particular method of repairs to the fai. This means that each mu fai only reconstructs the fai destroyed in the wet season to a limited degree. In order to avoid a monopoly of the water supply by a single system through such complete reapirs to the fai as made by the main season group, each mu fai is obliged to make merely supplementary repairs by using half split bamboo tubes in place of lak fai made of solid wooden stakes. The half split bamboo tube, a sort of lak fai but particularly called lak sae (threading stake), is normally made of a kind of bamboo, phai luak (Thyrsostachys siamensis) with a standard size of 2 sǫk (1 m) in length and 1 niu (2.5 cm) in diameter. In the work of repair numerous lak sae are driven around the main weir upstream and the intake. The partially repaired fai even with its large number of lak sae is not very strong and rather vulnerable, and by being so it is able to supply only a moderate amount of water, barely enough to irrigate the smaller operated area under dry season cultivation.

The member households of the dry season groups have obligations to provide construction materials as shown in Table 31. In addition to lak sae as the main construction material, there is an obligation to supply a small number of ordinary lak fai made of tüng stakes, which are used for quite limited repairs to the damaged parts of the main weir.

In three mu fai, the material inputs, in contrast to the main season groups, are basically levied not on the operating area but on the member household. The principle of proportional obligation is, here again, not applied in a strict sense. Inequality of obligation seems to exist among the dry season group of the Nǫng Plaman's mu fai, especially between a few rich peasants, mostly landlord-operators, cultivating soybeans on relatively large areas (1.00 - 8.00 rai) and the great majority of small-scale operators, mainly tenants and rural labourer's households, who cultivate soybeans, tobacco and occasionally early season rice on a quite small area (0.5 - 3.5 rai). In spite of such unequal responsibility, widespread dissatisfaction among the members seems to be limited. This is partly because the obligation of material supply among the members is currently not very heavy, compared with that of the main season group, and partly because most tenants and rural labourers are liable to be generally subservient to the landlords and landlord-operators in constant fear of their replacing tenancy contracts. In contrast to the main season group in which the principle of proportionality has traditionally been emphasised, the dry season group for recently developed and small-scale cash cropping has been managed with deviations from such a traditional norm.

In the above discussion, we have seen how supply obligations of labour and construction materials in maintenance activities are assigned to the member households in each sub-group of the mu fai. Now, in order to see how these labour and materials are actually mobilised, we shall focus upon the operations of the repairs to the fai and dredging canals which took place in the main season group of the Nǫng Plaman system according to the author's observations in 1975.

The Main Repairs to the Fai (14 and 15 May 1975)

The kae müang decided on 30 April that the first stage of the main repairs should be carried out on 14-15 May. All the members resident in the three villages, Chiangmai village, Qi village and Müang Pha village further downstream were then officially informed by the kae müang and pǫ fai. Traditionally the dates for the first repairs have been fixed between the waning moon of the eighth month (düan paet raem) and the waxing moon of the ninth month (düan kao khün) in the Lannathai calendar. This period roughly corresponds to May in the Gregorian calendar. It is widely believed that unless at least the initial repairs are finished during this period, the increasing volume of river water caused by the growing monsoon rainfall might make the driving in of stakes practically impossible. According to custom, the kae müang together with the pǫ fai selects an auspicious day for the repairs within that period, consulting a version of the traditional almanac (tamra phaen bohan), which has long been used by their ancestors.[23] The auspicious days for the works were thus fixed on Wednesday, the fourth day, and Thursday, the fifth day, of the waxing moon of the ninth month, i.e. 14 and 15 May. As soon as the dates were fixed and announced, the pǫ fai informed the phi fai of the schedule of repairs, making offerings of flowers, candles and joss sticks at the hǫ phi fai (the fai spirit house) erected in the area of hua fai. The bulk of lak fai had been carried out from the pae and piled up in every member's compound by the scheduled dates.

In the early morning of the first day all the members hauled lak fai required from them to the construction site on the left bank of the river, using carrying poles and ox-carts. At eight o'clock the kae müang took a rollcall of the members and then carried out an inspection

of the size and numbers of lak fai supplied by them checking against the records of the mu fai. No one was absent without notice, but there were 11 persons standing as substitutes for members out of 90 persons present. There were exclusively rural labourers hired by the landlord-operators and owner-operators at the rate of 10 baht per day. If someone had been absent, he would have been charged a fine of the same rate. After the inspection of the lak fai a few members who had brought some stakes below standard were ordered to supply extra stakes in the second repairs. Those who supplied an insufficient number of lak fai were charged a fine at the rate of 1 baht for a lak yai and 10 baht for 30 lak lek. The two kinds of tool, mallet (khǫn na waen) and big field knife (mit), requested from every member were also inspected and a few members who had left them behind had to pay 5 baht per missing tool.

After taking the rollcall and inspecting the construction materials and tools, the kae müang explained the schedule for the work: in the morning about half of the stakes would be driven in on the left bank of the supporting weir (fai nun nam); in the afternoon repairs to the sluice-gates (tae) and the driving in of stakes would take place; driving in stakes on the right bank and cleaning the fai spirit house and its adjacent area would be left for the next day. Then he ordered 26 members selected from Chiangmai villagers to cut down 13 tüng logs in the western pae and to haul them to the construction site. These logs called mai tae were to be used for constructing the sluice-gate. The rest started off their work of driving numerous stakes into the weir bodies. Under the kae müang's direction the new small stakes were driven between the old stakes used continuously for many years, to strengthen the foundation. The most seriously damaged areas were along

the sluice-gates and after-bay (khang nam) between the two weir bodies. These areas were carefully repaired and strengthened against the rapid current with large stakes, brush wood and large numbers of small stakes. The work of driving in stakes was carried out for exact periods of 50 minutes with 20 minute breaks from 9.00 to 12.10.

Lunch finished at one o'clock and the kae müang again brought all the members together at the construction site. Meanwhile, the 26 members sent to the pae during the morning had come back with 13 tüng logs measuring 6 m in length. They installed these logs across the sluice-gate with wire ropes and stakes. Other people continued to drive in numerous stakes in the same way as in the morning. After all the work scheduled had finished at three o'clock, the members broke up. On the next morning, 15 May, all the members assembled together again at eight o'clock and had a rollcall and an inspection of tools as on the previous day. All the members carried out the work of driving in stakes on the right bank throughout the morning. In the afternoon, while most members continued the same task, 15 members were assigned to clean out the fai spirit house and to pull up weeds which had grown up around the hua fai area in preparation for the coming fai spirit cult after the second repairs the following month. After completion of all the works at 14.35, the kae müang, announced the number of lak fai to be provided for the second round of repairs on the basis of the work already completed; round of repairs; every member was obliged to supply 2 lak yai and 10 lak lek per rai. The kae müang also fixed the dates of the subsequent work.

Dredging Canals (21 and 22 May 1975)

Immediately after finishing the first main repairs to the fai, the head regulator was closed down to drain off the water in the canals. For a week the water was left to drain off almost completely and the canal beds became exposed leaving scattered puddles. In such conditions the deposits of silt loam and clay loam on the canal beds, which are not yet dried up, are easy to dredge. On the morning of 21 May all the members assembled with their own tools on the left bank of the fai at eight o'clock. After taking the rollcall the kae müang checked the three kinds of tool necessary for the work to be brought by every member: the hoe or khǫbok which can be substituted by a spade (siam lua) for digging up mud and silt on the canal beds (luak müang), a soil-carrying basket or pǫ of woven bamboo splits, and a big field knife (mit ngong or mit nep) to be used for cutting brush and grasses. A few members who did not carry any of these tools were charged a fine of 5 baht per item.

The members were then divided into two groups to carry out dredging in the main canals; the one group of 40 members were assigned to dredging a portion of the main canal between the intake and the end of Ban Fai hamlet, a distance of about 600 m, and the other one of 50 members to dredging a portion between the end of Ban Fai and the end of Ban Klang hamlet, stretching about 800 m. The dredging operations were carried out rather in such limited spots as the bends and the back side of the diversion weirs (tae), where mud and silt mainly tend to be deposited. In addition to this, a more important task to be carried out was the removal of brushes and grasses along the canal banks; otherwise they could overgrow and become obstacles to the smooth flow of water in the subsequent periods. On the next day (22 May), all these

works were continuously carried out in the lateral canals, with the members divided into thirteen groups according to location of their operating lands. Throughout the operations the kae müang supervised all the groups spread over from Chiangmai village to Müang Pha village further downstream. All the works were completely finished at four o'clock, when it was announced that the next meeting for the second repairs to the fai were to take place on the 19 and 20 June.

The Second Repairs to the Fai and the Fai Spirit Cult (19 May 1975)

On the morning of 19 June all the members assembled on the left bank of the fai at eight o'clock as usual. The main purpose of the second repairs was to drive stakes in a smaller area of the main weir body which had been left in the previous repairs. However, the scheduled construction work on the 19 and 20 June was judged to be impossible due to the high flood conditions with water overflowing both weirs, as a result of several days' steady rain. The kae müang thus decided to postpone the repairs to next year leaving the prepared lak fai in each member's custody until the next repairs. The most laborious works for the annual maintenance of the physical system thus came to an end, to be followed by the fai spirit cult.

The fai spirit cult was performed by pǫ fai and his three assistants, at the hua fai area in which the crucial physical structures, particularly the fai and the intake, are believed to be protected by the spirit.[24] On the previous day they bought various materials for offerings at Mae Rim town, including a pig's head and four pig's legs which constitute the indispensable sacrifice offered to the spirit.[25] All the costs of the offerings were appropriated from the spirit cult fee (kha liang phi fai) of 2 baht from each member (see Table 29).

After invocation of the spirit to accept the sacrifice in the spirit house (hǫ phi fai) the spirit cult was completed within an hour and the pig's head and legs were cut into pieces for each member. Most members stayed in the pǫ fai's house to share the feast till late at night.

The major maintenance works on the physical system for the main season group are thus accomplished through the inputs of each member's labour and considerable amounts of construction material. The assignment of these obligations to the member households is partly based on the principle of proportionality to size of holding, which corresponds to that applied in the allocation of water. The principle is, however, disregarded in various ways, especially among the dry season group organised in line with the development of cash cropping. However, the main season group, which has traditionally evolved for peasant subsistence production, has steadily retained the principle, particularly in assignment of construction materials.

The main purpose of the fai spirit cult often stated by the members is both as a form of thanksgiving to the fai spirit for the successful allocation of water and maintenance of the system, and also to entreat the fai spirit to provide protection to the physical irrigation structures. This provides an explanatory framework of the cult in relation to peasant technology and the organisational arrangements. The entreaty for protection of the crucial structures is obviously required by the limits of indigenous technology which designs the fai as a temporary and low-durable structure. So far as the peasant engineering attempts to fulfil contradictory functions, i.e. irrigation and flood protection, damage to the facilities is inevitable. To this

end the spirit cult is an alternative technology designed to minimise the uncertain damage. The cult performed in anticipation of the uncertain damage can be viewed as a necessary complement to the construction works. The spirit cult is a mystical device to compensate for the technical inadequacy underlying the indigenous peasant engineering.[26]

Despite existing inequality in labour obligation, the egalitarian and co-operative social norm based on the ideal proportional privilege and responsibility is emphasised through the spirit cult and the subsequent feast. Emphasising co-operation and solidarity among the members, both rich landlord-operators and poor tenants, the spirit cult seems to provide a collective feeling, disguising the existing economic disparity among them, to support the present organisational arrangements of the mu fai.[27] Such a function of the fai spirit cult is very likely to stem from the traditional subsistence sector of rice farming where a co-operative norm is still preserved. However, the spirit cult is lacking and is no longer effective in the dry season group where cash cropping has developed and the egalitarian principle of proportionality is largely disregarded.

3. Irrigation under the Government Projects in Ayutthaya Village

(1) Rainfall and Inundation

In Ayutthaya village, water supply in rice cultivation is quite different from in Chiangmai village where people can secure a relatively stable water supply to the fields by means of the traditional müang fai systems. In contrast to Chiangmai's sophisticated irrigation, Ayutthaya's rice cultivation has long been dependent upon the crude forces of nature, i.e. uncertain monsoon rain (fon) and deep and prolonged inundation (nam thuam). In the village, the predominant main season cultivation

and its broadcast-sowing method are basically dependent on the local rainfall régime at the early stage of cultivation in the latter half of April and May. If the rainfall is insufficient or comes too late at the crucial period of sowing, cultivation is impossible or sowing comes so late that the young plants are drowned by sudden torrential rainfall and the first rise of flood water. Subsequently, it is affected to a greater or lesser extent by the inundation caused by annual flooding during the long growing period from August onwards. This inundation used to be unstable due to localised heavy rainfall and occasional overbank floods throughout the latter half of the growth period.

The inundation occurs on a vast scale, being caused by water drained from an enormous catchment area upstream. In terms of the sub-regions we have discussed in Chapter IV, the ricelands of the village along the Khanomčhin canal are situated in the southern part of a huge Retarding Basin extending from Phakhai to the Phraya Banlü canal along the Nọi channel (Figure 27). The Retarding Basin, having an average elevation of about 2 m above mean sea level, is subject to deep and long flooding by water drained from the Old Delta Proper and the Depression Belts, joined by further drainage water and rainfall in the region itself. The most marshy depressions can be seen around the Lat Chado swamp area west of Phakhai, where cultivation has suffered much loss in the past hundred years from extraordinary flooding,[28] but the inundation prevails all over the area of the Retarding Basin and can last from mid-July for a period of more than 5 months.[29]

In the area along the Khanomčhin canal under ordinary circumstances, the inundation attains its highest level of 1.5-2.0 m on the fields in late October and early November. Since the main drainage channels have a high water level in this period, the flood water cannot drain south.

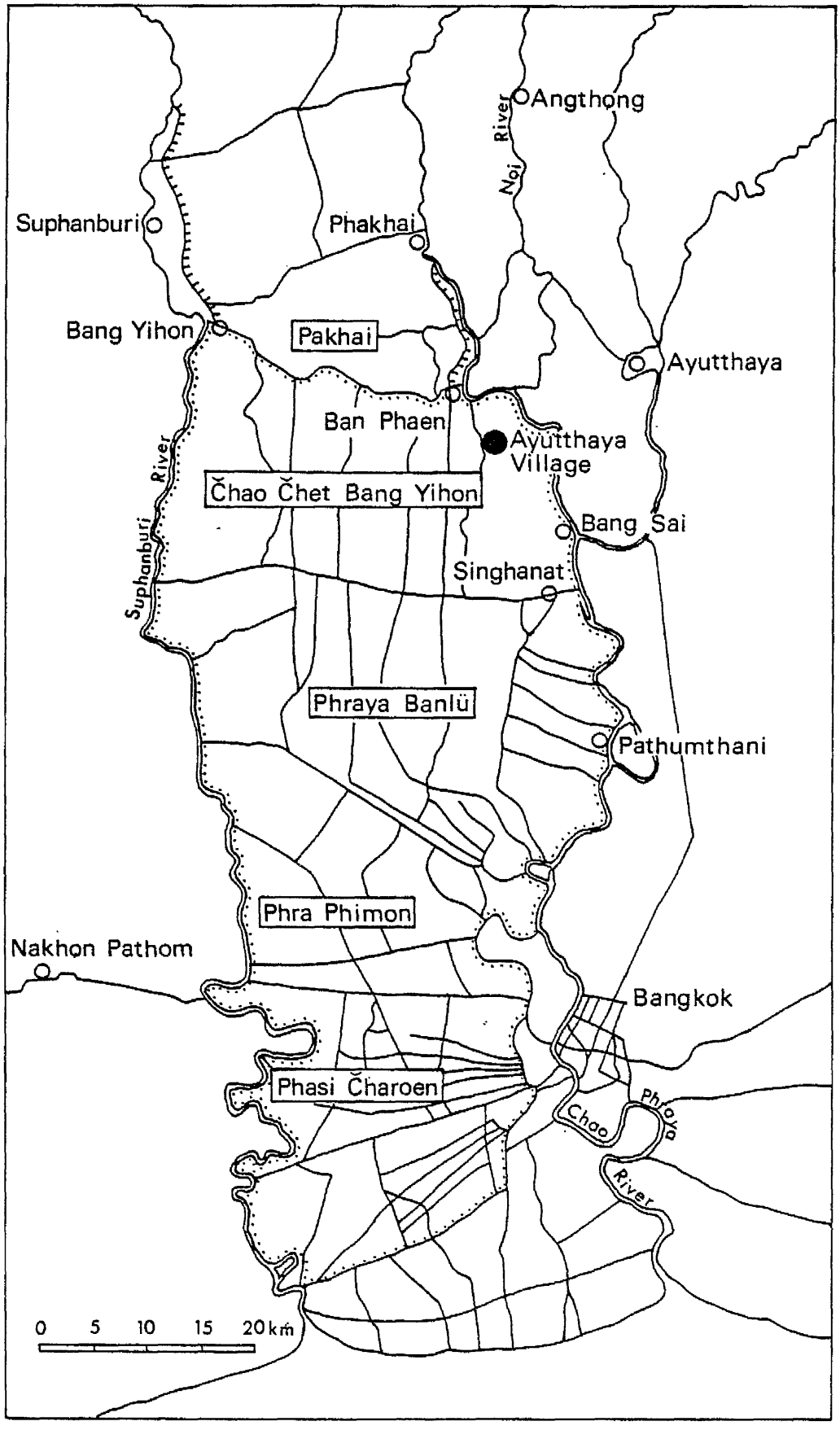


Figure 27: Irrigation Projects on the West Bank of the Chao Phraya

This maximum level of inundation is thus termed among the peasants nam song (stagnant inundation)[30] and is believed to provide a good yield. The prolonged presence of deep flood water in this area may be partially due to the slight elevation which occurs along the Phraya Banlü canal which runs east-west to link the Chao Phaya and the Suphanburi main channels.[31] By this transverse canal, the huge low-lying basin characterised by extremely deep flooding is demarcated from the Late Canalled Lowland stretching to the south. Southwards from this canal more favourable and stable water conditions for rice cultivation may be observed in the main part of the West Bank project area, where the early season cultivation of improved varieties has developed since the late 1960's. The Čhao Čhet Bang Yihon project area in which the Khanomčhin canal area is officially included, falls within the northern part of the West Bank project scheme and is subject to water control carried out by the Royal Irrigation Department (RID). Nevertheless, hydrological conditions in the Khanomčhin canal area, by contrast to the southern developed area, are rather similar to the depressions around Phakhai area. The fields along the Khanomčhin canal have still remained considerably backward in water control development up to the present day. Only after five or six weeks of nam song does the inundation begin to subside towards the harvesting season in December and January and the inundated water, after remaining for a considerable period, drains down southwards.

Under such circumstances, we encounter radically different conditions in irrigation management in Ayutthaya village from those in Chiangmai village. One of the chief characteristics of irrigation in the village is the total absence of any sophisticated water control system and its associated organisational arrangements comparable to

those of Chiangmai village. This poses a serious question in the ecological and technological context of Ayutthaya's rice farming. In answer to the question of why Ayutthaya village has never developed an indigenous irrigation system and its associated social organisation, we need to take into account the particular method of cultivation traditionally practised in the village.

As we shall see in the next chapter, broadcast-sown rice, mostly late varieties or extremely late varieties called 'floating rice', is normally cultivated under dry-field conditions relying only on monsoon precipitation during most of the vegetative growth period. The ecosystem of the flooded field begins only after inundation in August. Thus it might be said that broadcast-sown rice essentially goes through two different ecological conditions: the dry-field ecosystem and the wet-rice ecosystem. Such a complex system of cultivation method is a result of adaptation to the climatic and more significantly hydrological conditions. During the first half of the cultivation period, any attempt to draw water from the Khanomchin canal would be impossible with the technology and labour available in peasant communities, due to the low level of water in the canal and the flatness of the terrain. Thus in the context of the dry-field ecosystem during this period, the peasants' primary concern is for monsoon rainfall. Unable to control this factor, peasants turned to a rain-making ritual as an alternative technology. On the other hand, during the latter half of the cultivation period, the normal flooding is indispensable for the wet-rice ecosystem, and rice varieties are selected in relation to the flood pattern. The problem is the annual fluctuation in the timing and depth of inundation. In the absence of an authority powerful enough to organise and carry out large-scale hydraulic works, control of inundation by the villagers would

be altogether impractical.[32] However, in the village there have been some attempts to lead inundation water into the fields by small-scale construction and dredging works within the limits of peasant engineering. Thus we can locate two kinds of peasant activities practised at least in the past in relation to irrigation in Ayutthaya's broadcast-sowing cultivation, i.e. the rain-making ritual for the first half of the cultivation period and the small-scale water control works for the second half of the period.

The rain-making rite or phithi khǫ fon, which was practised in the village until about the mid-1950's, is one of the most widespread rituals in the Delta farming region and is called hae nang maeo (parade of the female cat). In times of rain shortage for land preparation and sowing in broadcast-sown fields, one or more villagers well acquainted with various rituals, used to make a proposal to hold a ritual parade of hae nang maeo, persuading many villagers to participate. On the day of the ritual the paraders carried a female cat, a symbol of dryness, in a bamboo basket through the village beating drums and gongs, dancing and reciting a rain-making verse. They called at every house, where a member of the household poured water on the head of the female cat, simulating the rain to be invoked. If rain did not come after the ritual, it used to be repeated until there was a certain indication of rain.

The hae nang maeo ritual is an alternative technology seeking to relieve a grave anxiety among the cultivators of broadcast-sown fields in the face of the uncertainty of the monsoon rainfall. Similar rituals are quite widely found not only in the Delta farming region but in many other traditional agrarian societies of South East Asia and elsewhere.[33] However, it was never linked with any organisational arrangements

comparable to those of mu fai in Chiangmai village. Thus, the rain-making ritual in the village ceased rapidly when the belief in the efficacy of magic gave way to vague expectation of irrigation improvement on a large-scale, to be carried out by the government in the late 1950's.

On the other hand, the small-scale engineering works carried out by the peasants in early days have ceased for many decades. During the pioneering days early in this century, a small tertiary canal was constructed, albeit a modification of an existing natural watercourse, so as to lead inundation water into the fields. This was the Tontan canal, which, with a length of about 2 km, linked the Khanomčhin canal with the Rang Khok drainage channel to the east. Although the precise year of excavation is not clear, it is said that the work was done at the beginning of this century by the co-operative labour of peasants who began to reclaim plots in the Tantan field, the main field of the village stretching along the east bank. Thirty or fourty peasants seem to have worked together in the construction work which lasted about two weeks. It can be considered that this tertiary canal, providing not only inundation water but also access to the uncleared area, facilitated the pioneering reclamation then under way. However, after its completion, though there were a few minor dredging works, no other public works to improve water control were undertaken by the village peasants. This is largely because, after the wilderness was completely cleared and reclaimed, such a canal became of less significance in broadcast-sown cultivation under large-scale inundation. The Tontan canal like many other small artificial or semi-artificial canals in the delta, which had originally been constructed for reclamation in the early periods, seems to have declined in importance and to have largely

remained unmaintained.

In contrast to Chiangmai's müang fai systems with their deliberately designed weirs and sophisticated distribution networks, the Tontan canal is simply an inundation canal constructed on extremely flat land, which can convey water only in relation to the water level in the Khanomčhin and Rang Khok channels. The small canal might confer a benefit upon the fields immediately flanking it for a brief period at the beginning of inundation, but inundation is eventually so widespread that it covers the entire area along the Khanomčhin canal. Thus, in so far as broadcast-sowing cultivation is predominant, such a small inundation canal has no very important function in relation to the overwhelming extent of the flood. Under such circumstances, there has been no systematic allocation of water in this inundation canal and therefore there has evolved no traditional idea of water rights among peasants associated with irrigation. For these reasons, Ayutthaya's irrigation which relies upon inundation seems to have had little requirement of organisational arrangements which might be related to allocation of water rights and continuous maintenance of a physical system.

The discussion of the two major peasant activities practised in the past, the rain-making ritual and the small-scale canal works, indicate a lesser significance of organisational arrangements in Ayutthaya village than in Chiangmai. The ritual as an alternative peasant technology was certainly collective but was essentially lacking in an organisational basis. The canal works, another kind of irrigation activity, were carried out for reclamation of the wilderness, but had ceased after the close of the frontier for riceland reclamation. The rain-making ritual and the inundation canal works are indeed a peasant

technology, which have been developed in close relation to broadcast-sown cultivation in face of the uncertainties of nature. However, the peasant technological response to nature tended to be lacking in organisational basis and disappeared along with the development of the government water control projects.

(2) Irrigation Improvement under the Government Projects

During the past few decades the peasant technology practised in irrigation has given way almost completely to large scale water control projects of the government. The peasant technology in Ayutthaya village represented by rain-making rites and small-scale canal works was limited and passive in nature. It is also quite different from the modern technology of water control which aims to create a new water environment over a quite large area, combining such purposes as irrigation, drainage, flood control and water conservation.[34] Large scale water control projects based on such modern technology began to be planned in the early years of this century, but only finally materialised in full scale in the 1960's.

On the west bank of the Chao Phraya several trunk canals transverse to the Suphanburi river were already in existence at the end of the nineteenth century, when the Ministry of Agriculture dredged the Khanomčhin canal under the leadership of Phraya Kasetraksa to provide easy access to the uncultivated wilderness (Tanabe, 1978: 78). These included in the area under study, the Čhao Čhet Bang Yihon canal and Phraya Banlü canal. Although these canals led to an improvement in water transport between the two major river channels and to some extent stimulated the expansion of ricelands along them, at the same time, they often caused obstruction to drainage in the depressions

(van der Heide, 1903: 25). Van der Heide, a Dutch irrigation expert from Dutch East Indies refers to such conditions in this area in his report in 1903 as follows:

> "Moreover the dykes of excavated earth along the klɔngs [canals] add no small part to the natural obstructions against drainage and so at the time the water in the rivers and in the klɔngs is rising to the highest level and rainfall is still heavy, the very lowest parts often become flooded for some time as deep as 2 m and more. In these conditions only na müang paddy [floating rice] can be cultivated" (van der Heide, 1903: 47).

The river and canal systems, thus described, and the expansion of riceland in the Khanomčhin canal area are shown in Figure 28. As far as the Tontan field is concerned, the wilderness had almost disappeared by 1906, except in the area southward along the Rang Khok. Although most of the areas westward from the Khanomčhin were still left uncultivated at that time, they too were transformed into ricelands by the 1920's.

In 1903, van der Heide drew up a highly ambitious master plan for a water control scheme covering the whole of the Chao Phraya delta. Three years later, he proposed a smaller and more moderately designed project for the west bank (K.S.9.2/48). According to his official report, submitted by the Minister to the throne, the proposed West Bank scheme was part of a greater project which aimed to expand ricelands up to 500,000 rai on the west bank of the Chao Phraya. This was to be achieved by water control with two main feeding canals: one from the Khanomčhin to the Maenam Ɔm canal north of Bangkok, and another from Bang Yihon to the Mahasawat canal along the east bank of the Suphanburi river (Figure 29). The former, with a total length of 48 km, was to be excavated from the site of Wat Manwichai of Ayutthaya

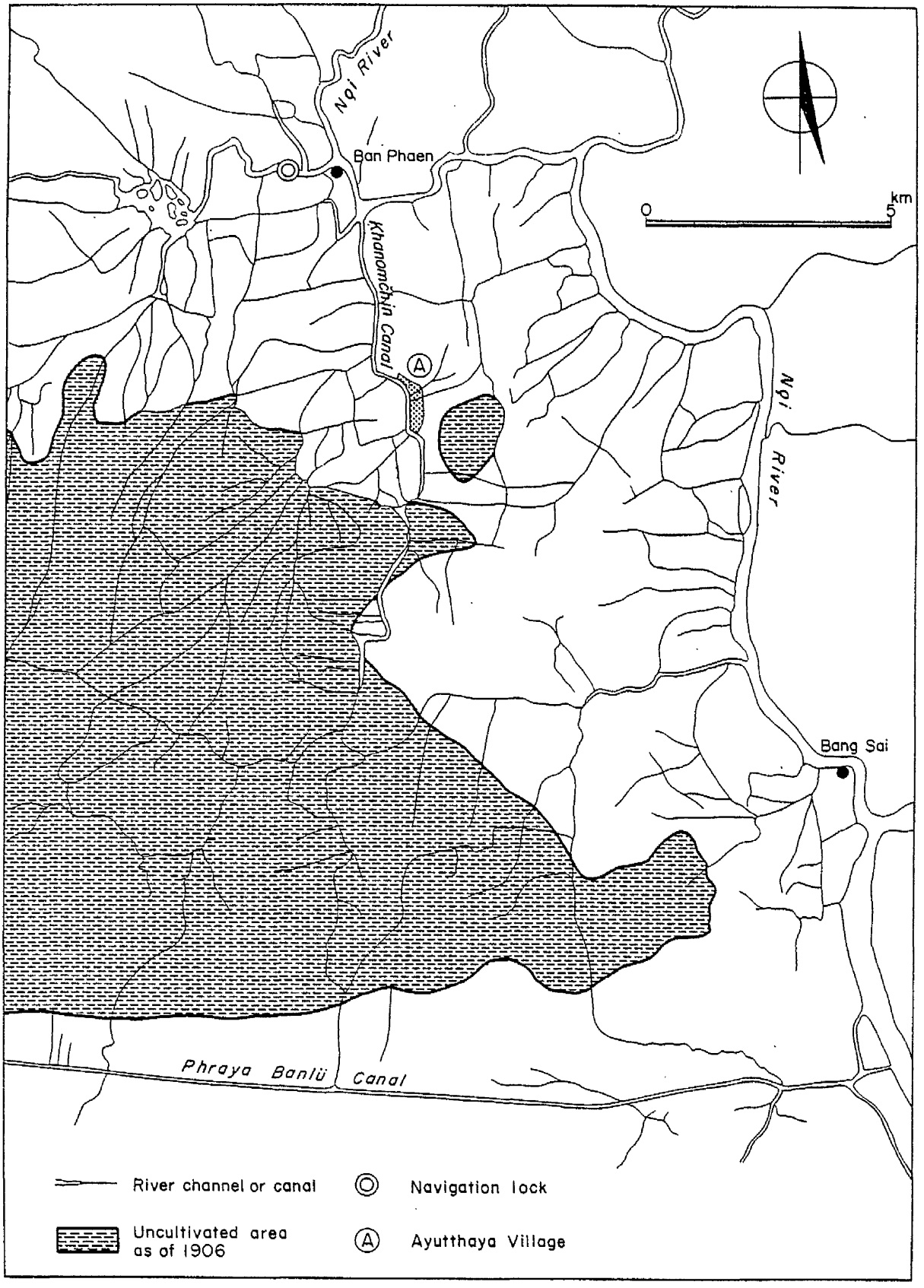
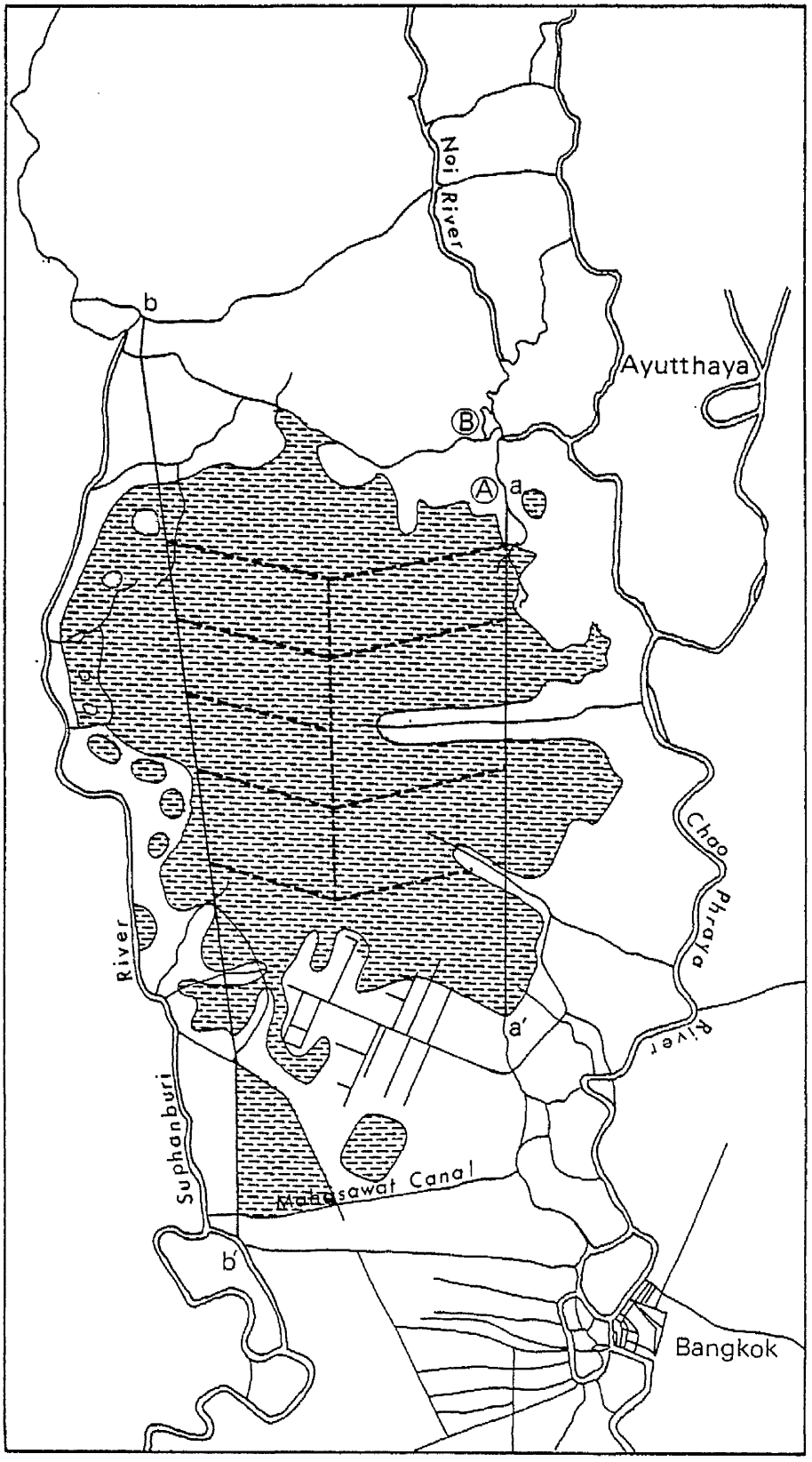


Figure 28: Water Control within the Khanomčhin Canal Area as of 1916



a——a Proposed alignment of the West Bank main canal

b——b Proposed alignment of the Suphan main canal

- - - - Proposed alignment of branch canals

▨ Uncultivated regions concerned

Ⓐ Ayutthaya Village

Ⓑ Ban Phaen

Source: K.S. 9.2/48

Figure 29: The Proposed General Plan of the West Bank Scheme, 1906

village, then called Wat Prachanman, linking with the existing Khanomčhin canal. Locks and head regulators, one of which was to be installed at the mouth of the Khanomčhin canal, would perform the function of controlling inundation and would secure a stable supply of irrigation water to the fields. And during the flooding season,

> "although the flooding on the fields along the Sikuk river [the Nọi river] goes as deep as about 1.5 m, the depth of inundation along the newly excavated canal will be kept within limits of 0.40 to 1.20 m" (K.S. 9.2/48).

It was intended that this magnificent scheme for water control on the west bank thus proposed would be completed and in operation to the full capacity required, within eight years. The total cost of the scheme was estimated at about 3 million baht,[35] and if compared with the total expenditure of about 57 million baht required for his proposed Greater Chao Phraya project, amounted to only five per cent of the latter (van der Heide, 1903: 125). Nevertheless, the government decided to postpone the West Bank project as well as the larger water control scheme and instead opted for the less expensive 'reduced capacity project' in 1906 (Thailand-Royal Irrigation Department, 1915a: Vol.3, 19). The main reasons for the postponement seem to be the question of how to populate the area, even if conditions were suitable for clearance as a result of the proposed water control, as well as the heavy expenditure required to complete the project (Thailand-Royal Irrigation Department, 1915a: Vol.3, 19; Thailand-Royal Irrigation Department, 1915b, 1-4; Small, 1973: 4).

In any case, the water conditions in Ayutthaya village could not be improved to any extent for a long time, because the projects concerning the west bank had been almost ignored. After van der Heide's resignation

from the Department of Canals (krom khlǫng) in 1909, a series of smaller schemes such as the Suphan and Pasak projects together with the improvement of the existing trunk canals was carried out from 1913 onwards under the recommendation of a British irrigation team headed by Sir Thomas Ward. In the area concerned, some locks were installed to facilitate navigation, and dredging was carried out in the Čhao Čhet Bang Yihon canal in this period (Thailand-Royal Irrigation Department, 1915a: Vol.3, 31; Boranratchathanin, 1961: 11). However, the government paid little regard to the improvement of water conditions in the Khanomčhin canal area until the establishment of the West Bank project in 1939 (Thailand-Royal Irrigation Department, 1927: 3-7).

More than three decades passed from his 1903 proposal before van der Heide's proposal for the West Bank project was revived. Initially, this plan aimed to supplement the natural drainage system with newly excavated canals such as the San canal which runs parallel with the Khanomčhin canal to the west. These canals, it was hoped, would reduce the high levels of inundation caused by occasional heavy rainfall and by spillage of excess water. At the same time, as a result of the expansion of ricelands into the wilderness, a more stable water supply began to be required for the early period of cultivation when local rainfall is still unreliable. In order to make use of the water in the canals to meet such demand, some regulators and sluices were constructed for the conservation of irrigation water. In addition to these works, the embankment and reinforcement of the natural levees along the Chao Phraya, Nǫi and Suphanburi rivers were undertaken as flood prevention measures. Thus water control in the project can be characterised by water conservation with flood protection to secure water for the early period of cultivation (Sukit, 1969: 1-2). Although

these improvements and constructions slowly continued even after World War II, the water supply during the first half of the cultivation season was still inadequate and unreliable. Sufficient water could not be given to the areas through the upstream channels such as the Nφi and Suphanburi rivers until the completion of the Chao Phraya diversion dam at Chainat.[36]

In addition to the feeder canals, numerous lateral and tertiary canals constructed since the 1960's up to the present have provided fairly favourable conditions for transition from the traditional broadcast-sowing method of cultivation to the transplanting method. In extensive areas relatively close to the canals, in fact, a remarkable transformation of cropping patterns has taken place since the late 1960's (Sukit, 1969: 6-7). The early season cultivation which involves the use of the newly developed non-photosensitive varieties, such as the RD series, in the first half of the main season cropping, starts in April or May and is harvested in August or September by the time deep inundation occurs.[37] Double cropping has also been partially introduced, particularly in the area close to the canals where the water is available even in the dry season.

These remarkable developments, caused by the recent improvement of water control have taken place, however, in the southern parts of the West Bank tracts south of the Phraya Banlü canal. Most of the northern area in which Ayutthaya village is situated still continues under the traditional broadcast-sown cultivation with its adaptation to deep inundation. Despite the implementation of improved water control which has certainly been in progress as shown in Figures 30 and 31, the relatively early occurrence of deep flooding does not yet allow transplanting cultivation around Ayutthaya village. As far as the Tontan

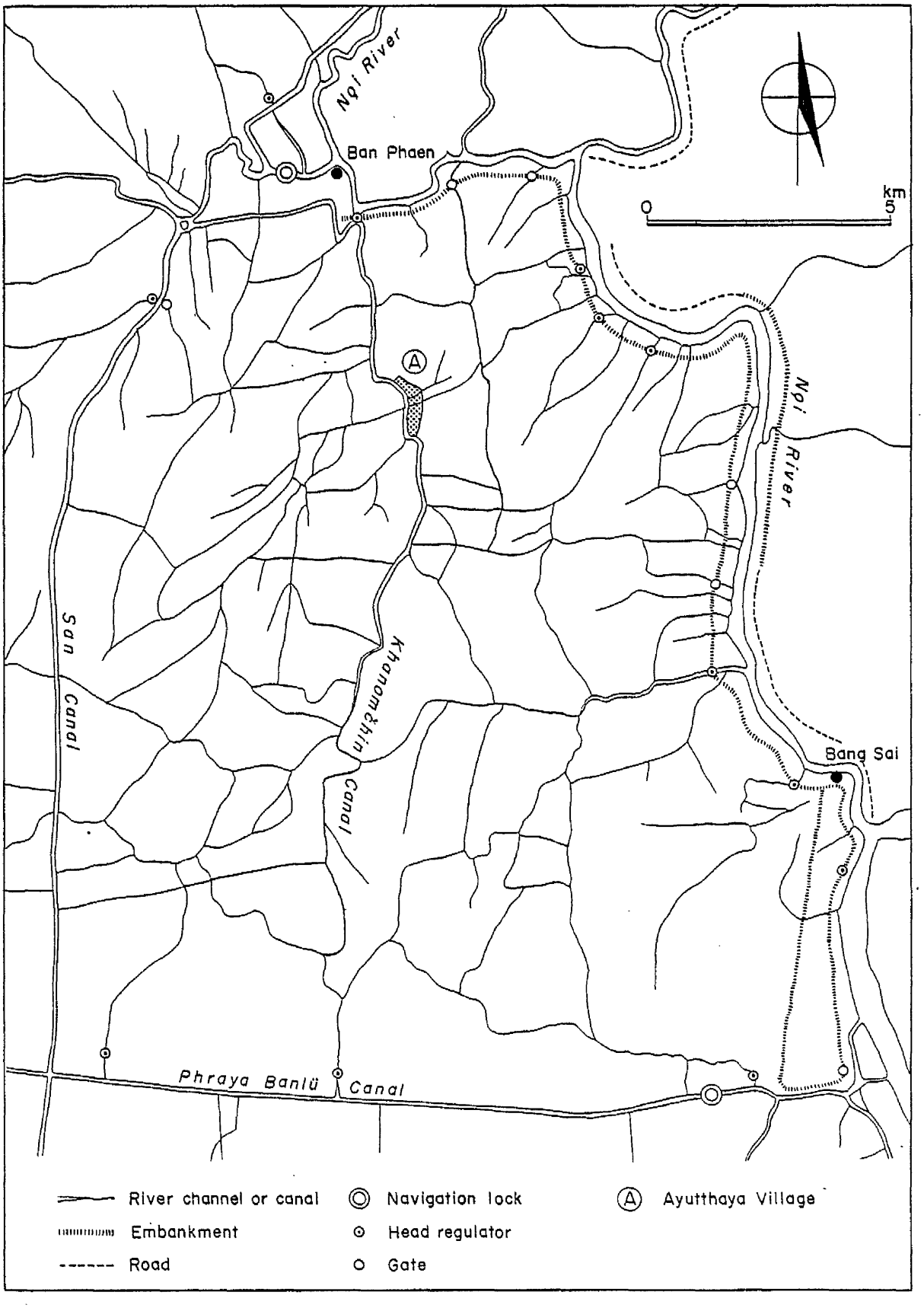


Figure 30: Water Control within the Khanomčhin Canal Area as of 1969

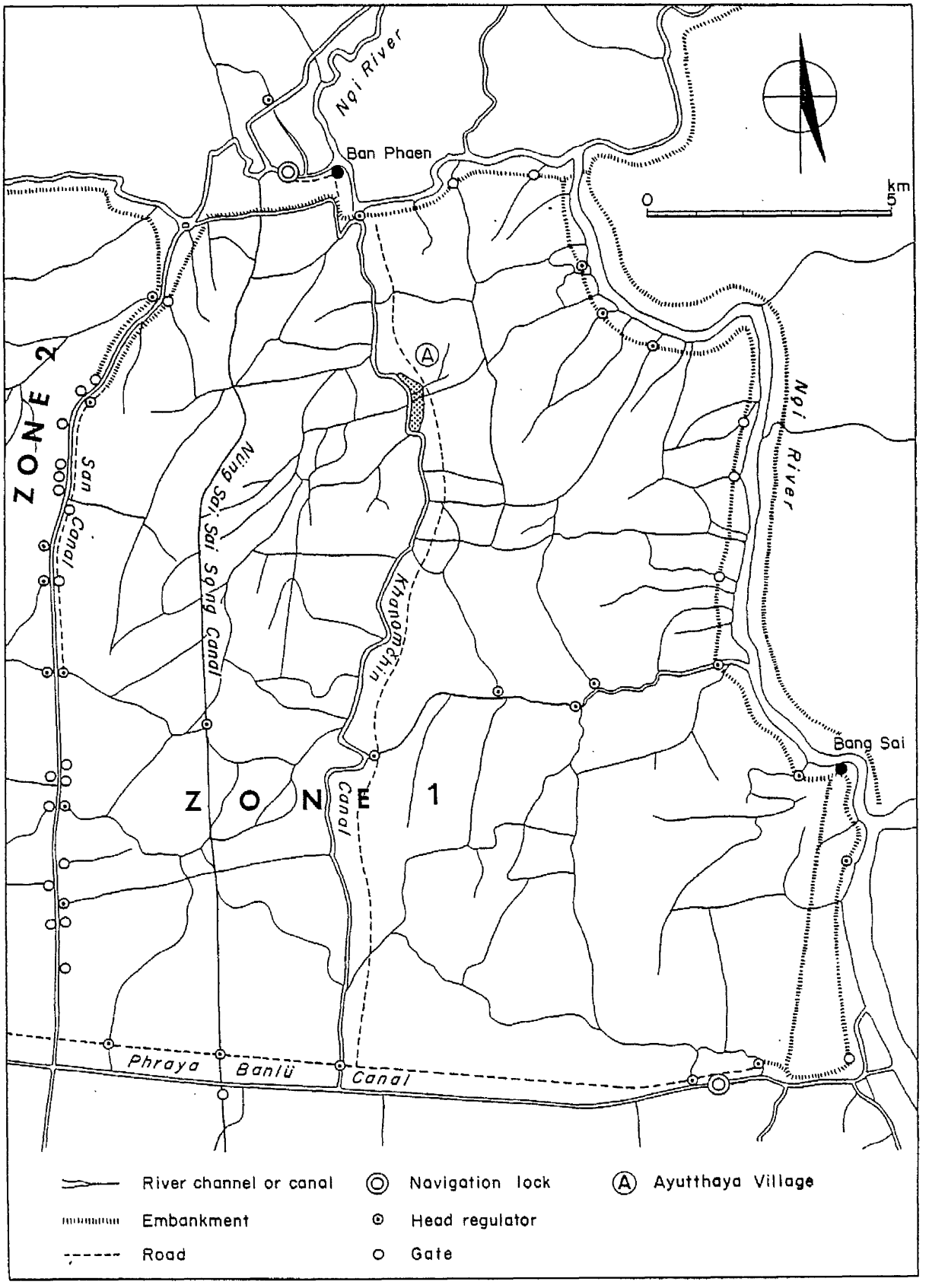


Figure 31: Water Control within the Khanomčhin Canal Area as of 1977

field on the east bank of the Khanomčhin canal is concerned, the water conditions still make it impossible to adopt the cultivation of transplanted rice on any significant scale. The complete water deficiency up to April and deep inundation commencing July or August seem to prevent in most areas of the Tontan field extensive adoption of early season cultivation which would normally last from February to September. Any attempt to drain excess water through the Nǫi river in order to encourage early cultivation can cause unexpected flooding of the Chao Phraya main channel further downstream near the Bangkok metropolitan region (Thailand- Royal Irrigation Department, 1978: 3). Therefore, broadcast-sown cultivation dependent on rainfall is still necessarily practised in the village. And the spread of early season cultivation by the transplanting method is strictly limited to the area immediately adjacent to the Khanomčhin canal.[38]

Under such circumstances the RID has recently made efforts to develop improved water control in the northern part of the West Bank tracts (Thailand-Royal Irrigation Department, 1978: 1-2). The area surrounded by the Čhao Čhet Bang Yihon canal, the Phraya Banlü canal, the Suphanburi river and the Nǫi river has become a subdivision named the Čhao Čhet Bang Yihon project (khrongkan songnam lae bamrungraksa čhao čhet bang yihon). In order to render water control in the project area more effective, embankments together with roads have been constructed along the main rivers and canals surrounding the area. Newly excavated canals and numerous natural water courses are connected with the outer channels by the head regulators installed across the embankments. The project area is subdivided into three zones, demarcated by major feeder canals. Each zone is surrounded by embankments or dikes of excavated earth along the canals together with a

number of regulators as in Zone No.1 shown in Figure 31. Through such construction works in progress, water conditions around the village will be more stable and as a consequence, transplanting culture might emerge under a new cropping pattern in the traditional region. However, before thinking about the future development in line with the ongoing water control projects, we have to consider the managerial arrangements of the government projects and the peasant response to them in the village studied.

(3) Operation and Maintenance of Irrigation in the Village

The water control scheme thus developed is directly operated and maintained by the RID. The State Irrigation schemes such as the Čhao Čhet Bang Yihon project, unlike the rather small People's Irrigation projects, such as Chiangmai's müang fai systems, constructed and maintained by the water users concerned, are managed under the complete control of the RID, the government agency, through its bureaucratic organisation. Under huge and complicated water control systems such as the Greater Chao Phraya scheme, water allocation to even lateral canals is organised within the total plan of water distribution. Because the water conditions in one project area are systematically affected by those in other areas, localised water control is impossible. Moreover, the concept of water rights which have been familiar among Chiangmai's peasants seem to have never evolved under the uncertain hydrological conditions of the deltaic environment. Reflecting these reasons, a highly centralised management system has been adopted throughout the area covered by the Greater Chao Phraya scheme.

Moreover, where operation and maintenance of the facilities is concerned, the peasants' participation as water users is still by and

large minimal. In some areas in the Old Delta Proper where water supply has always been adequate and stable and dry season cropping is being operated, peasants have developed a fairly good organisation for maintenance of lateral canals and farm ditches (Small, 1974: 694; Kaida, 1978: 231). On the other hand, it is usually observed in most of the project areas in the delta that the peasants' co-operation as well as their participation is generally lacking in the maintenance of the facilities (Small, 1974: 692).

In the case of Ayutthaya village, the operation of water control is organised outside the village. The Khanomčhin canal, the crucial main channel for irrigation and drainage to the Tontan field, is regulated by the two head regulators installed at each end of the canal. The operation of these regulators is under the control of two zone-men or nai truat chonprathan luang under the order of the Čhao Čhet Bang Yihon project office at Singhanat, at the mouth of the Phraya Banlü canal. The zone-man, an official for small units of operation appointed by the RID, has as his main duties the control of the amount of water in the canal through the head regulator, reporting water levels and other data to the office, and the supervision of canal maintenance.[39] The zone-man is also expected to keep in close contact with the peasants and to collect cropping data in the area concerned. However, the relationship between the zone-men and the villagers is not well-established and the latter regard them only as officials who administer the operation of canals and no more.

In the areas where more efficient water control is achieved by the construction of lateral canals and ditch-and-dike networks, ditch riders or nai truat na are appointed in the smallest irrigation units to coordinate co-operative activities and transmit peasants' requests

for irrigation to the zone-man.[40] But the area along the Khanomchin canal has not yet been improved sufficiently to have a ditch rider who would be necessary in an area of sophisticated water control. In the Tontan field the deep and prolonged flooding has still not been overcome despite the fact that inundation has been stabilised to an extent through the recent improvements. At any rate, the villagers appear to be neither satisfied with the present water conditions nor to have any incentive to participate in the maintenance of water control. It may even be said that, at the moment, they are rather indifferent to the official management of water control.

The village does not contain a single peasant organisation relating to the maintenance of canals and other water control facilities. Nor is there anyone who individually joins such organisations outside the village. Apart from the earlier example of small canal construction and dredging during their pioneering days, co-operation in water control has been rare among the villagers. In the delta region, by contrast with the intermontane basins, an indigenous co-operative organisation of water control has hardly been developed at all.[41] Nevertheless, since the late 1960's, the RID has been making efforts to establish and foster the Water Users' Association or samakhom phu chai nam chonprathan among the peasants involved in state irrigation projects throughout the country. It aims to achieve an appropriate water allocation to the users' plots through co-operative maintenance of facilities and to encourage the cropping patterns most suitable to the improved water conditions (Metha, 1978; Vanpen, 1978: 11-15). However, such attempts to create co-operative organisation among the peasants have not been very successful in the areas of deep flooding.[42] For the moment, no Water Users' Association has been established in Amphoe Sena or Amphoe

Phakhai, the central areas of the Retarding Basin sub-region (Thailand-Čhangwat Phra Nakhǫn Si Ayutthaya, 1970: 20).

Nevertheless, the recent development of the government water control improvements has provided rather different irrigation conditions in the deep inundation areas including the Khanomčhin canal area. Despite the unimproved conditions during the rainy season, the water level in most canals of the area has become stable during the former water deficit period from February to April, so that ample water can be sent to feed the developing early season cultivation in the main part of the West Bank project area immediately downstream. This means that deep inundation areas like the Tontan field have recently become pathways of water for the further development of early season cultivation downstream, and during the past few years (since around 1970), the Khanomčhin canal has been able to receive an adequate water supply for the early season cultivation. In a few plots immediately flanking the canal some villagers are able to cultivate early season rice. However, this is not a result of the improvement of the terminal network of water allocation. The villagers can obtain sufficient water for transplanting from the Khanomčhin canal only by using water-lifting devices, include the power rahat and power pump called thǫ sup nam, which are installed on the bank of the canal.

In common with many plots of the Delta farming region, irrigation by means of these water-lifting devices indicates a completely individualised form of water use. It is radically different from the highly co-operative irrigation based on sophisticated physical systems in Chiangmai village and also from absolute dependency on rainfall and inundation, long practised in the Tontan field itself. By contrast to both these traditional irrigation practices, irrigation by water-lifting devices

requires privately owned motorised machinery and thus considerable fuel expenses for its operation. In the village there are only twelve such devices which are individually owned, mainly by rich peasant households and occasionally rented to relatives. Moreover, due to the lack of lateral and tertiary canals except for the Tontan canal, the early season cultivation by this irrigation method has to be confined within very narrow limits only along the Khanomčhin canal. Therefore, this early season cultivation is practicable only to those who have their own holdings along the canal or who are able to rent in these holdings. Such a trend of water management has already been observed in many advanced areas within the government irrigation improvement, especially in the main part of the West Bank project immediately south of the Khanomčhin canal area.

At least in the case of Ayutthaya village the water control projects undertaken by the government have operated and are maintained almost without the peasants' involvement. At the present stage of the Čhao Čhet Bang Yihon project which has not yet brought about a satisfactory solution to the deep inundation problem, the villagers have little incentive to participate in water control as a whole. It can be said that the continued irrigation improvement during the past few decades has not brought about such a remarkable change in water conditions as to provide among the peasants any powerful stimulus to water control. Far from that, the water conditions during the period for the main season cultivation remain almost unchanged. Therefore, the traditional broadcast-sown culture still predominates, in response to the forced and total reliance upon the uncontrollable rainfall and inundation. However, even among the peasants of Ayutthaya village, there seem to have been signs of change in relation to irrigation

management in recent years. Irrigation by motorised waterlifting devices,which has begun to be practised by some rich peasant households for the early season cultivation in a limited area, is dependent on recent improvements. It can be assumed that irrigation managment by individuals will increase along with the expansion of early season cultivation by the future development of government water control projects.

4. Conclusions

In this chapter we have devoted our discussion to the contrasting irrigation practices in the two villages, focusing upon their physical structures and hydrological conditions, organisational arrangements and management in operation and maintenance. In both villages the irrigation practices can be theoretically viewed as a complex organisational technology in which the physical system or its absence is closely articulated with organisational arrangements and managerial requirements.

In making an ecological comparison first of all, we have to emphasise the physiographical and hydrological environment underlying irrigation practices in both villages. Chiangmai's peasants in a tributary valley of the intermontane basin have been able to indigenously create and develop small-scale müang fai systems utilising a limited but controllable water resource. It represents a highly artificial and complex alteration of the land and water resources, which could be achieved within limited peasant technology only through massive inputs of labour and material made continuously over many years. Chiangmai's elaborate transplanting culture is indeed founded on this complex peasant technology.

By contrast, Ayutthaya's hydrological environment in the delta has been basically beyond the control of village peasants and they could only respond passively to it. Traditional dependency of Ayutthaya's rice farming on the monsoon rainfall and the 'flood irrigation' by annual inundation indicate the only feasible way of adaptation to such uncontrollable crude nature. Ayutthaya's extensive broadcast-sowing culture is a quite rational response to this in terms of choice of rice varieties and timing of various farming operations, adjusting to the occurrence of monsoon precipitation and flooding as we shall see in the next chapter.

Taking into consideration these contrasts of irrigation practices in the ecological context, we can suggest some significant socio-economic implications underlying the irrigation practices in both villages. Chiangmai's peasants have long organised themselves into a highly co-operative mu fai under complex customary regulations for use of a limited water resource and face inevitable requirements in maintenance of the physical system, i.e. annual repairs to the fai and dredging canals. The customary regulation, based on the recognition of water-rights, has laid emphasis upon the assignment of privilege and responsibility to the member households, including sharing of water according to area operated and inputs of labour and materials in maintenance. The fai spirit cult, which is a further facet of this, has functions not only as the alternative technology to enhance the solidarity of the mu fai, but also in disguising the existing economic disparity among the member households.

By contrast, rather passive and individualistic response to nature is predominant in every aspect of Ayutthaya's irrigation practices, having almost no indigenously developed physical system, and

therefore no organisational arrangements and regulations. It may be said that in the delta farming system,with traditional orientation towards petty commodity production by contrast to Chiangmai's subsistence farming, the initial basis for co-operation was limited to a considerable degree. The total dependence on nature as the traditional way of farming has recently been accompanied by a strong reliance on the government water control under the RID official management. With the rapid involvement in the government water control projects, Ayutthaya's irrigation is likely to move towards even more individualistic and capital intensive practices, particularly with the advance of the early season cultivation.

CHAPTER VII

FARMING TECHNOLOGY II: FARMING OPERATIONS

The main purpose of this chapter is to examine the contrasting processes of farming operations currently practised under the different irrigation environments and socio-economic conditions of the two selected villages. In any type of cultivation farming operations are essentially a coherent and systematic series of interrelated tasks undertaken within a given ecological and socio-economic context. Taking this into account, we shall focus our description and analysis upon the transplanting method in Chiangmai village and the broadcast-sowing method in Ayutthaya village, which represent the traditional and predominant methods of rice farming in their respective communities. Before going to substantial descriptions of the two methods of cultivation, we shall first suggest general contrasts in the land-use pattern and agricultural cycle between the two villages. In the subsequent sections we shall attempt to describe the entire process of farming operations in its various stages, examining each major task with regard to the tools and labour involved. In Chiangmai's transplanting cultivation, the labour-intensive nature of farming operations with its strong orientation towards subsistence production will be demonstrated. By contrast, Ayutthaya's broadcast-sown cultivation will be seen to be of a less labour-intensive character carried out over a more extensive area and aimed at petty commodity production. Finally, by making a comparison of the contrasting farming operations, we shall demonstrate fundamental differences of peasant farming technology between the two villages.

1. General Contrasts in Land-use and Agricultural Cycle

As we have briefly discussed in the foregoing chapters dealing with the regional characteristics of the two farming systems, farming operations in rice cultivation are a technologically interrelated process, largely determined by irrigation method. The irrigation methods and practices long established in the two villages have structural relationships with the particular cultivation methods, i.e. transplanting and broadcast-sowing, in which a series of farming operations from land preparation up to storing the paddy for consumption or sale are sequentially interrelated. In the previous chapter we have discussed the relationships between the physical systems of irrigation and organisational arrangements of the peasants. Bearing in mind these crucial aspects of peasant irrigated farming, we now move to the question of how such a complex process of farming operations is practised and organised in the given ecological context. This chapter is an attempt to elucidate the entire process of peasant farming technology in rice cultivation and its relationship to socio-economic factors, in the context of the two villages under comparison.

In order to answer the question we first need a detailed description of all the operations and techniques involved in the cultivation method predominant in the two villages. Here the term 'cultivation method' does not only mean merely the method of sowing or of planting as indicated superficially by the terms 'broadcast-sowing' and 'transplanting', but a consistent and systematic process of cultivation customarily practised in a specific ecological context. In this sense our discussion will focus upon the transplanting cultivation of the main season in Chiangmai village and the broadcast-sown cultivation of the main season and the transplanting method which has

recently been practised in the early season in Ayutthaya village. These cultivation methods, particularly the former two which have long been established in the villages, show a high degree of efficiency and technical rationality within the given local conditions,[1] as often pointed out by scholars in relation to traditional rice cultivation in Thailand and elsewhere (Grist, 1975: 139; Moerman, 1968: 26-27). Most of the tasks in farming operations are neatly interwoven with each other and are closely bound up with environmental factors, particularly with water conditions and irrigation practices. It is conspicuous that each of these tasks is carried out by using particular tools in production and through a particular pattern of labour use. Our task is thus to describe and to analyse the complex technological process of farming operations in relation to tools and labour utilisation[2] practised in the two villages.

Before commencing substantial discussion of farming operations, it might be useful here to draw some general contrasts between the two villages with regard to land-use pattern and agricultural cycle. Generally speaking the land resources of Chiangmai village have been primarily devoted to the subsistence production of main season glutinous rice for home consumption, lasting approximately eight months from late May to early January. All the plots under the main season rice are cultivated exclusively by the transplanting method under the well-maintained müang fai systems. During the subsequent period cash cropping of soybeans and tobacco has recently become popular within a limited area insofar as the müang fai systems can provide the reduced water supply.

Throughout the four main fields operated by Chiangmai village, soils are composed of highly productive deposits of silt loam and clay

loam. This together with the efficiency of the müang fai systems, contributes to the high yield level (54.56 thang/rai on average) in the main season cultivation. Every cultivated plot located within the terminal network of a müang fai system is carefully levelled and provided with relatively high and carefully built dikes about 30 to 40 cm in height. A single plot is normally subdivided by dikes into several small parcels of 0.5 to 1.0 rai in area in order to regulate effectively the level of standing water in each parcel.[3] Chiangmai's subsistence production has long been carried out on increasingly smaller and more highly modified land resources on which has been invested a steady accumulation of peasant labour.

On the other hand, Ayutthaya's land resources, which are considerably larger than those of Chiangmai village, have been concentrated on the monoculture of main season non-glutinous rice with a strong orientation towards commodity production. After securing subsistence needs for home consumption, a considerable part of the product in main season cultivation has been assigned to market sale. Depending on the monsoon precipitation and the prolonged deep inundation, broadcast-sowing lasting approximately ten months from May to February is still predominant throughout the Tontan field and adjacent area. Early season cultivation by transplanting, which is basically a substitution for the traditional broadcast-sowing, has recently come to be practised only in a small area, due to only limited improvements in the irrigation environment. The acid-sulphate soils on brackish water alluvium, which are widely developed throughout the field are largely of low productivity[4] and only wet-rice can be grown successfully under the flood conditions. A major water shortage during the dry season, together with the poor soils, make

off-season cultivation quite difficult in most of the plots of the Tontan field.

The size of the many plots cultivated using the broadcast-sowing method is quite large, varying in area from 5 to 20 rai (0.8-3.2 ha) and their ground level is often uneven. Therefore, at the beginning of the rainy season, in the same plot some portions contain stagnant water, while others are dry. Subsequently, of course, the whole area is submerged with the rising inundation. Each plot is surrounded and subdivided by low and coarse dikes less than 25 cm high, which are not designed to conserve water, but instead merely demarcate the boundaries of ownership. The only exception is a small area of transplanting along the Khanomčhin canal which have been evenly levelled and equipped with high dikes for more intensive transplanting cultivation. So far as the broadcast-sown plots which represent the greater part of Ayutthaya's cultivated land are concerned, the degree of artificial modification of land resources through investment of peasant labour seems to be far less than that attained in Chiangmai village.

Tables 32 and 33 show the land-use pattern of wet-rice and other major field crops in terms of cultivation seasons and cultivation methods in the two villages during the season of 1974-75. The total area operated by the 112 operating households surveyed in Chiangmai village amounted to 701.50 rai, compared to the 1,223.00 rai operated by 44 households in Ayutthaya village. In both villages there is a strong preference for main season rice cultivation on most available land resources; 100 per cent is planted with transplanted rice in Chiangmai; more than 90 per cent is planted with broadcast-sown rice including both samruai (dryland sowing) and phǫloei (wetland sowing) methods and the rest (9.6 per cent) is assigned to transplanted rice

TABLE 32: Land-use Pattern in Chiangmai Village, 1974-75

	Period of cultivation	No. of plots**	Area planted (rai)	% in total operated area***	Area harvested (rai)	% in area planted
Main season cultivation*						
Transplanted rice	May-Jan	112	701.50	100.0	688.50	98.1
Off season cultivation						
Transplanted rice	Jan-May	3	11.00	1.6	11.00	100.0
Soy-bean	Jan-May	46	80.25	11.4	65.00	81.0
Tobacco	Jan-Apr	81	77.25	10.0	73.25	94.8

* Cultivation of upland rice (khao hai) in the pae is excluded (See Table 23).

** Total operating households are 112. In addition to these households, the numbers of households for soy-bean and tobacco cultivation in the table include another 50 households not regarded here as operating households, i.e. 48 rural labourer's households and 2 non-farm households.

*** Total operated area (riceland) is 701.50 rai (See Table 23).

Source: 1974-75 Survey.

TABLE 33: Land-use Pattern in Ayutthaya Village, 1974-75

	Period of cultivation	No. of plots*	Area planted (rai)	% in total operated area**	Area harvested (rai)	% in area planted
Main season cultivation						
Broadcast-sown rice						
Samruai method	May-Feb	43	1,045.75	85.5	1,018.75	97.4
Pholoei method	May-Feb	9	60.00	4.9	60.00	100.0
Early season cultivation						
Transplanted rice	May-Sept	14	117.25	9.6	117.25	100.0
Off season cultivation						
Transplanted rice	Feb-July	1	8.00	0.7	8.00	100.0
Green gram	Apr-July	9	38.75	3.2	17.50	45.2

* Total operating households are 44.

** Total operated area (riceland) is 1,223.00 rai (See Table 24).

Source: 1974-75 Survey

in early season cultivation in Ayutthaya. Transplanting cultivation in the early season is practised by only 14 households, and this newly introduced practice is more market oriented than the traditional broadcast-sowing cultivation.

Crop failure mainly caused by drought and flood have occurred in both villages.[5] In Chiangmai village a small-scale flood occurred in October 1974, resulting in damage to 1.9 per cent of the transplanted rice. As we have pointed out in the previous chapter, however, a deficiency of water supply from the Mae Rim river has been a more frequent problem and drought damage has affected Chiangmai's fields on average once every five years. Such drought has damaged as much as 5 to 10 per cent of the total planted area and has sometimes led to violation of the customary regulations for the use of irrigation water. Drought damage has often occurred in Ayutthaya's broadcast-sown field as well. In 1974, shortage of rainfall meant that 2.6 per cent of the broadcast-sown rice was damaged by drought after sowing. Depending almost entirely on rainfall, without any supplementary water supply from the Khanomčhin canal, the broadcast-sown fields are constantly vulnerable to water shortage, particularly during the early stages of cultivation. In the Tontan field, crop failure caused by excessive inundation at the ripening or early growth stages is relatively rare. According to the statistics of annual rice cropping compiled at the Sena District Office (Ban Phaen), broadcast-sown rice throughout the district has been damaged almost every three years due to water shortage during the dry spell in July and August, though damage recently has not exceeded 3 per cent of the total area planted. All these facts seem to indicate that crop failure on such scales in both villages has not seriously threatened the peasants' subsistence, at least in recent years.

With respect to off-season cultivation, there is a considerable difference between the two villages in planted area and number of planted plots. In Chiangmai village where land resources are inadequate for subsistence production in the main season, such cash crops as soybeans, tobacco, and transplanted off-season rice (glutinous)[6] are cultivated in 130 plots by 110 households covering 23 per cent of the total area operated. It should be noted that the 110 households are not necessarily the same households as regularly operate the land in the main season but include 48 rural labourer's households who rent in only quite small areas for cash cropping of soybeans and/or tobacco. This indicates a growing demand for land for off-season cultivation, particularly among poor peasants. As we have already discussed, however, a major expansion of off-season cultivation has been precluded due to insufficient water supply from the müang fai systems during the period concerned.

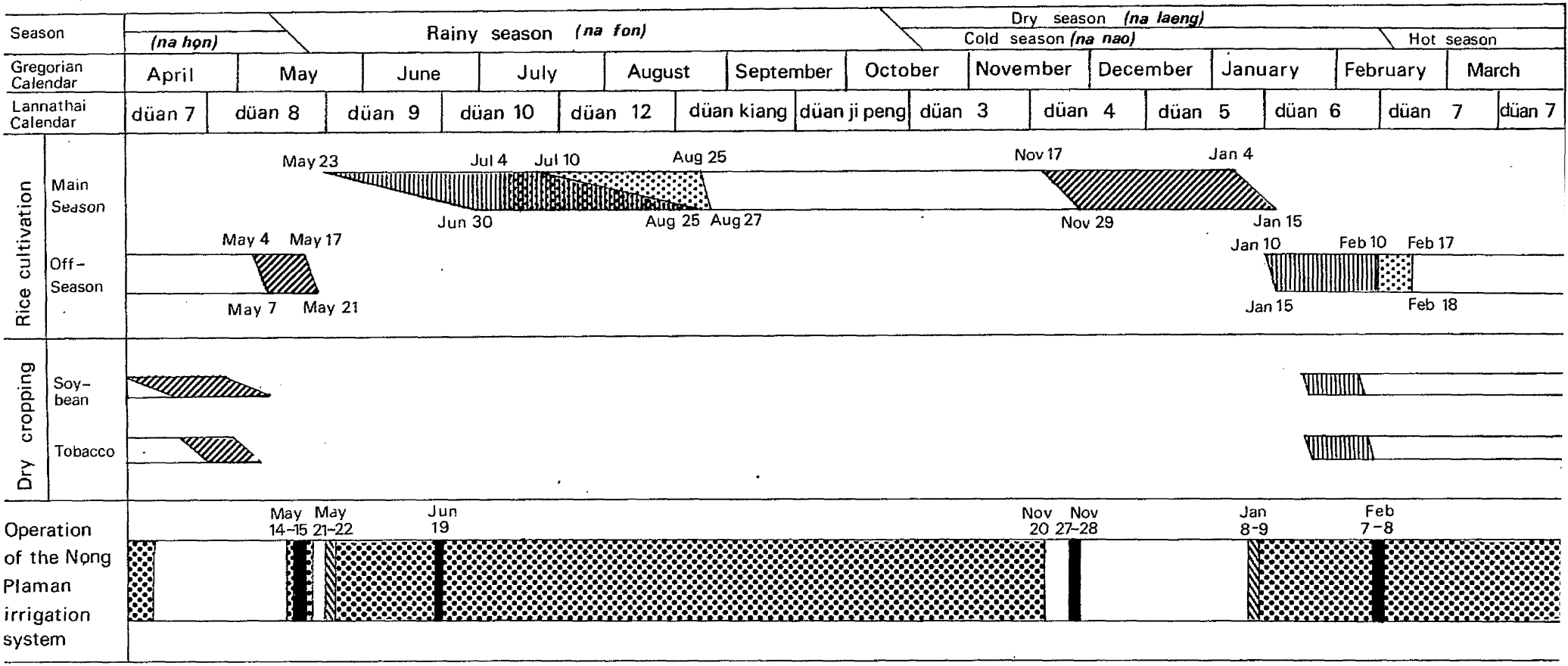
On the other hand, off-season cultivation in Ayutthaya village covers rather less than four per cent of the total area operated. This lack of development of off-season cultivation coincides with the great stress placed on the main season rice cultivation. Due to the long duration of main season rice farming lasting from May to February and the subsequent shortage of water in the dry season, there has been little opportunity for off-season cropping. In addition to this, the low productivity acid-sulphate soils also make successful cultivation of upland crops rather difficult.

During the past few years some households have tried to grow green gram (thua khiao) on small portions of land near the canal, but the expected yields have not been obtained. Thus, the possibility of further development of off-season cash crops is practically precluded,

so long as the present main season cropping pattern centred around long-duration broadcast-sown rice remains.

The land-use patterns of the two villages, which we have briefly discussed above, can be illustrated as agricultural cycles as shown in Figures 32 and 33, which particularly emphasise the relationship between land-use and water conditions. The main season cultivation of Chiangmai village exclusively starts in late May immediately after completion of the main repairs to the fai and the dredging of the canals in the müang fai systems, and lasts until December or at the latest mid-January. Uprooting and transplanting of seedlings, which are the most crucial operations throughout the entire process of transplanting cultivation, take place normally in July and August when the water supply from the müang fai systems becomes completely stabilised with the increasing amount of monsoon precipitation. Harvesting and subsequent operations basically begin after shutting the sluicegate of the main regulator in November and before opening it for off-season farming by the 'dry season group' of the mu fai in January. It can be thus said that the entire process of Chiangmai's main season farming is systematically bound up with the co-operative management of irrigation by the mu fai. Every peasant decision on timing of farming operations fundamentally and precisely corresponds with the irrigation practices carried out in co-operation. This, of course, also applies to off-season cultivation by the peasants of the 'dry season group' from January to April or May.

Contrasting to Chiangmai's systematic relations to the irrigation systems, the main season farming of Ayutthaya village is basically designed to adapt directly to the patterns of monsoon rainfall and inundation. It begins with the arrival of the first rainfall in late



Period from land preparation

Period of uprooting-transplanting

Period from harvesting to threshing

Repairs to the *fai*

Dredging of canals

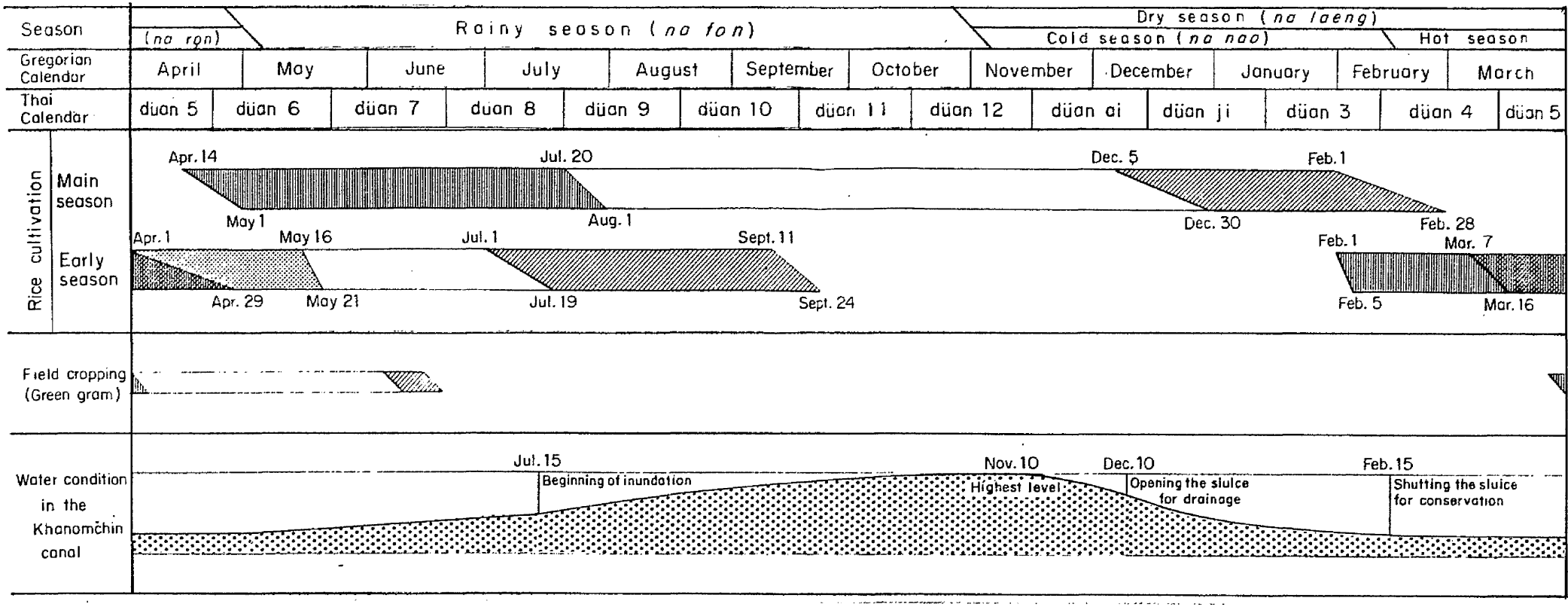
Period of irrigation

Period in which transplanting proceeds, while land preparation still continues in other plots

o indicates the date at which operations begin in each plot

x indicates the date at which operations end in each plot

Figure 32: Agricultural Cycle in Chiangmai Village



Period from land preparation to sowing

Period of uprooting—transplanting

Period from harvesting to threshing

Period in which transplanting proceeds, while land preparation still continues in other plots

o indicates the date at which operations begin in each plot

× indicates the date at which operations end in each plot

Figure 33: Agricultural Cycle in Ayutthaya Village

April or May soon after the wan songkran or the traditional New Year's Day, and lasts until January or at the latest mid-February. The traditional broadcast-sowing method uses indigenous late varieties, with a long maturation period of 180-250 days, which corresponds almost exactly with the inundation pattern. Growing in accordance with the rising inundation level, they normally survive at the highest water level in November and can be harvested between December and January. The drainage of flood water is accelerated by opening the sluice at the regulators installed in the Khanomčhin canal in early December in order to facilitate the harvesting tasks. Choice of indigenous late varieties and the adjustment of the entire process of cultivation to rainfall and inundation represent the most crucial parts of peasant technology in the Tontan field.

Since 1970 such a traditional cropping pattern has been partly replaced, as we have mentioned in relation to irrigation practices in the previous chapter, by the early season cultivation made possible by improved water control. This newly adopted cropping system was also made possible, however, through the introduction of improved non-photo-period sensitive varieties and the use of power-driven water-lifting devices. Having non-photoperiod sensitivity and a short maturation period, the new rice varieties allow the peasants to commence cultivation in the latter half of the dry season (February and March) and to harvest before the high inundation comes. It can be said, therefore, that the new varieties are accepted not for double cropping after the traditional main season cultivation, but for early season cropping outside the period of deep inundation.[7] Because the water level rises after harvesting, subsequent cultivation of any kind of crop is practically impossible. Thus, the early season cultivation in Ayutthaya

can be regarded as an alternative to the long-established cropping by broadcast-sowing. The use of water-lifting devices, new varieties, and other industrial inputs such as fertiliser and herbicide which are all associated with the early season cultivation certainly suggest a possible radical change in the socio-economic conditions of the village.

In the course of the above discussion we have made a brief comparison by giving a basic account of the land-use and agricultural cycle of the two villages. We have seen a basic contrast between two highly distinctive methods of cultivation, each of them fitting neatly into its ecological and socio-economic context. We now turn to describe, in detail, the entire process of the methods of cultivation which are currently practised in the two villages, in order to show the rationale of the traditional peasant technology and to examine the use of the main production inputs of labour and technology in the various processes.

2. Transplanting Cultivation in Chiangmai Village

For the peasants of Chiangmai village and elsewhere in the Intermontane Basin farming region, transplanting cultivation has been the only method of wet-rice cultivation. As we have noted in Chapter III, the division between the transplanted field (na dam) and the broadcast-sown field (na wan) which prevails in the delta region seems to be totally absent in Chiangmai village. Among the peasants the Lannathai term 'na' always refers to the transplanted wet-rice field irrigated by müang fai systems, and the Siamese agronomic term, na dam (transplanted rice field) is rarely used in the village context. The only distinction is with na hai, the cultivation of upland rice in the marginal pae and this specialist use in peasant terminology seems to

reflect the long history of transplanted wet-rice cultivation in the area. According to the villagers' folktales concerned with their pioneering days in the early nineteenth century, it is said that the ancestors cleared the wilderness and opened 'the rice fields for planting rice seedlings (na hü puk khao ka)' in the Nong Plaman field (N1) by the initial construction of their own fai, and in the Huai Sai field (H1) by receiving surplus water from the existing system of Huai Sai. It can be assumed that most rice fields in the village since this initial reclamation have been successively opened and cultivated as transplanted fields[8] supported by the müang fai systems and their co-operative water management.

Taking into consideration a much wider regional focus outside the village, traditional specialisation in transplanting culture seems to go back as far as the thirteenth century or even earlier when Tai Yuan and other Tai ethnic groups were still on the process of establishing political power in the Intermontane Basin farming region of northern Thailand. Some versions of the Chiangmai Chronicle (Tamnan Chiangmai) and Yonok History (Phongsawadan Yonok) also refer, in relation to a famous müang fai work in Chiangmai basin, to the transplanting of khao ka (khao kla) or rice seedlings before the foundation of Chiangmai by King Mangrai in the late thirteenth century.[9] Since then transplanting culture supported by well-maintained müang fai systems has been consistently retained as the basic technology of peasant subsistence production throughout the region.

Given transplanting cultivation as a historical and cultural legacy among Lannathai peasants, our inquiry is thus directed to the question of how the peasants in Chiangmai village organise and integrate their means of production and labour into a consistent complex

of operations within their own transplanting culture. In the following part we attempt to describe the entire process of cultivation according to each stage of farming operations. For the purpose of descriptive convenience, the process can be divided into some major stages.

(1) Selection of Varieties

All seed varieties used in the main season transplanting system are native or locally improved photo-sensitive varieties of glutinous rice with an approximate growth period of between 130 and 165 days. In the village, as is common throughout the Intermontane Basin farming region, there are no varieties which require an extremely long maturation period of more than 170 days, as often seen in Ayutthaya village and elsewhere in the Delta farming region to the south. The village peasants classify the existing varieties into three categories mainly according to maturation period: khao dǫ (early variety) khao klang (medium-term variety),[10] and khao pi (late variety). The varieties cultivated in the village during the 1974-75 cropping season are shown in Table 34 in terms of the traditional classification.

Cultivation of glutinous rice as the staple crop is overwhelmingly dominant and, even in the off-season, RD 2, a non-photo-sensitive variety of glutinous rice, is adopted over a small area. In an agronomic context, most of the main season glutinous varieties, particularly those classified as khao klang and khao pi have relatively high photo-period-sensitivity. Thus, they flower and ripen largely at fixed dates, being highly susceptible to day length shortening towards December (Watabe, 1967: 41-43). However, khao dǫ rice such as moei nǫng may be of lower photoperiod-sensitivity. Reflecting the physiological nature of the varieties, the peasants tend to remember better the date of

TABLE 34: Rice Varieties in Chiangmai Village, 1974-75

Traditional classification	Name of variety	Harvesting date in 1974-75	No. of plots for primary choice*	Approximate duration of growth
khao dǫ (early variety)	moei nǫng (dǫ müang fang)	Nov 17-Nov 21	2	130
	dǫ daeng (lai dǫ)	Nov 25-Dec 10	44	145-150
khao klang (medium-term variety)	san patǫng	Dec 10-Dec 28	22	155-160
	kam phai	Dec 15-Dec 28	4	155-160
	lai mon	Dec 15-Dec 29	2	155-160
	lai san sai	Dec 10-Dec 15	1	155-160
	luang yai	Dec 15-Dec 20	7	155-160
khao pi (late variety)	lai ton kham	Dec 20-Jan 5	25	160
	lai daeng	Dec 27-Dec 30	1	160-165
	lai pi	Dec 25-Jan 5	4	160-165
Total			112	
Improved variety	kǫ khǫ sǫng (RD 2)	May 13-May 19	3	120

* The total numbers of households surveyed are 112.

Source: 1974-75 Survey.

ripening and of harvesting for their selected varieties, rather than the number of days or months of growth before harvesting. For the peasants who select a particular variety, the date of harvest is almost exactly fixed and takes on a great significance. On the other hand, there seem to be a relatively wide range of dates for nursery sowing (May 25 - July 8) and accordingly for transplanting (July 4 - August 27), according to water availability in the müang fai systems. It should be noted, however, that the range is considerably narrower, given the more stable water supply for these operations through the müang fai systems, than is common in Ayutthaya. Taking this into consideration it may be realised that the peasants can set, by selection of varieties, a particular time framework for their individual production processes.

Selection of varieties in such a time framework is also closely related to the different physical conditions in the various parts of the four main fields. Among the ten main season varieties cultivated, the most popular in the 1974-75 cropping season was dǫ daeng,[11] one of khao dǫ rice varieties, which has a relatively early maturation date, and was adopted as the primary choice by 43 out of 110 households. Dǫ daeng, introduced to the village in the early 1950's, has the advantage of an early maturation date which enables the peasants to carry out harvesting in late November and early December. This means that the peasants are able to avoid the period of sudden fall in temperature towards mid and late December and to secure the new harvest for home consumption earlier, when the supplies from the previous harvest are almost being exhausted in most small-scale operating households. The early harvest also allows the peasants to commence off-season cultivation of upland crops in early January. Cultivation of this variety so attractive to many peasants, however, requires stable

water supply throughout the growth period and must avoid low-lying plots subject to deep flooding due to its relatively poor resistance to drowning. Do daeng is, thus, widely adopted on the higher portions of all the main fields.

The famous san patong rice which is a locally improved khao klang variety released at San Patong Rice Experiment Station, Chiangmai, seems to have been introduced in the late 1960's as an alternative to other existing medium-term varieties. It is widely said that the variety has extremely high yield potential under the condition that irrigation water is strictly controlled and appropriate amounts of fertiliser such as ammo-phosphate are applied (Watabe, 1967: 117-118; Calavan, 1977: 82, 86). However, san patong also shows poor resistance to flooding and drowning. In the village this variety adopted by 22 households, is cultivated, therefore, exclusively on the higher plots of the fields, particularly in the northern part of the Nong Plaman field (N1) where good water control in the plots is always possible and excess water can be effectively drained downstream. Unlike the cases in experimental stations, however, san patong planted in the village has never attained an extremely high yield, rather remaining at the moderate yield level of 50 to 65 thang/rai in common with any traditional varieties.

Another variety frequently chosen is lai ton kham, one of the khao pi varieties, with a late maturation date for harvest normally in late December through to early January. Lai ton kham which has long been planted together with other late varieties, is particularly well suited to the low-lying deeply flooded plots, customarily called na hong, given its strong stalk and resistance to lodging and to disease. The plots primarily adopting lai ton kham belong to 25 households and are

mainly located in the downstream and lower portions of a müang fai system, particularly in southern part of N1 field of Nǫng Plaman and the Huai Sai field (H1 and H2). In these na hong, drainage of standing water can only successfully be made after other parts of the fields, so that they are the last to be harvested.

It can thus be said that the distribution of the selected varieties is mainly governed by their maturation date and by the delicate water conditions of plots within a müang fai system. In addition to this ecological context, another factor to be considered is the orientation towards subsistence production. Since Chiangmai village's rice production has been mainly oriented towards securing glutinous rice for home consumption, there are only a few households, including non-cultivating landlords, who sell rice to local rice traders and rice mills.[12] Among 13 operating households who sold rice, mainly landlord-operators and owner-operators, 6 households made san patǫng their first choice because of its sale value, due to its heavy grain. However, this choice was made only by the rich peasants who have their holdings in a favourable position for good water control. Most operating households, however, show more preference for consumption quality including cooking quality, and in this connection dǫ daeng and lai ton kham, the two dominant glutinous varieties, have had a good reputation among most peasant households.

The subsistence orientation among the majority of the peasants is further emphasised when we take into account the fact that, in most cases (78 out of 112 households), they adopt one or more secondary varieties to be raised in a smaller portion of their plot. Although several combinations of khao dǫ, khao klang and khao pi do occur, a particular combination which includes dǫ daeng as the primary or second

choice is frequently observed, in as many as 62 out of 78 cases. Most peasants seem to try to grow as much dǫ daeng as water conditions allow. This is, according to the explanation often made by many peasants, mainly because of its early maturation and stable and moderate yield (50 - 60 thang/rai), which enables the peasants to obtain consumption supplies during the period of potential food shortage in November and December, [13] and partly because of the superior taste and cooking quality. Employing several varieties, as often recognised among subsistence peasants, can generally be regarded as a method of risk aversion (Scott, 1976: 22-23). At the same time, this technique obviously serves to spread the labour demand over different dates during the harvest period, one of the most hectic times for every peasant household (Demaine, 1974: 10). It is thus considered to be a technology of diversification of risk and labour. It should be noted, however, that the diversification of varieties results from deliberate peasant choice in relation to the specific ecological context. Among Chiangmai's peasants, particularly those with small operating plots, seed selection is particularly related to the acquisition of rice for home consumption during the period of shortage in November and early December.

(2) Land Preparation

Almost all the preparatory works and operations in main season cultivation begin with the commencement of irrigation tasks required in each mu fai in the latter half of May. Ploughing and its subsequent operations normally start after completion of the first repairs to the fai and the dredging of the canals. The sluicegate of the main regulator is fully opened to convey water throughout the members' plots and every

parcel and plot to be ploughed is flooded with the water drawn from the pak tang nam (farm turnout). The land preparation necessary for transplanting cultivation is basically carried out under flood conditions with a traditional wooden plough (thai) with an iron coulter for single furrowing, wooden harrow (füa) and a bamboo levelling log attached to the harrow (mai piang), all of which are drawn by a single water buffalo.[14] Ploughing, harrowing and levelling by the traditional tools of plough agriculture constitute the process of land preparation in both the nursery bed and main field.

Land preparation using buffaloes as motive power has long been practised and still predominates in the village and elsewhere in the Mae Rim valley. Modern power devices such as tractors and power tillers had not been introduced in the village at least up to 1975 when this research was carried out. Despite this total reliance on draught buffalo, Chiangmai village has traditionally owned a relatively small number of buffaloes. In 1974-75 there were only 20 households[15] who owned one or more head, accounting for less than 20 per cent of the total number of operating households. The greater number of households have to rent in buffaloes during the period of operations, normally lasting for a few weeks up to around two months depending on area operated. The buffaloes for rent are supplied mainly from several downstream villages situated along the Chiangmai - Fang highway, where water buffalo husbandry for renting purposes is a prosperous enterprise due to a more open and aquatic environment. In the village and adjacent area in the mountain valley, buffalo rents have customarily been extremely high, fixed at the rate of one old tang of paddy (30 litres = 1.5 thang) per day for the whole period of rental including non-working time.[16] This currently amounts to 6.4 thang per rai on average (1974-75),[17]

for a field both ploughed and harrowed and is as much as a quarter to a third of the present level of land rent under the widespread share-cropping or yia na pha koeng in the village.

In addition to this heavy input of draught power, Chiangmai's land preparation is characterised by an elaborate technical procedure requiring a long period. The necessary steps and the length of time required on them may be shown by a typical example of an 8 rai holding with a single buffalo in the Nong Plaman field (N1) as follows:

(a) Ploughing for 10 days.

(b) Leaving weeds to rot for 3 days.

(c) First harrowing for 5 days.

(d) Leaving weeds to rot for 10 days.

(e) Second harrowing for 5 days.

(f) Leaving for 1 day before transplanting commences.

(g) Levelling for 1 day.

The entire process thus requires 35 days altogether, in which a buffalo actually works for 21 days, taking rest for 14 days.[18] Thus the total actual labour expended per unit area is 2.6 days/rai, which represents a higher intensity than the 1.2-2.0 days/rai in Ayutthaya's land preparation by buffalo power.

One or two days before ploughing starts, a plot is filled with standing water approximately 7 to 8 niu (17.5 - 20 cm) deep, which is controlled by the farm turnout, and by cutting the dikes between parcels. Ploughing is carried on successively in each parcel of the plot, rotating always to the left. The plough depth is not very deep, at approximately 4 niu (10 cm).[19] In the Chiangmai system, greater concentration seems to be laid upon the subsequent steps of

weeding and harrowing which can be efficiently carried out only under a well-maintained irrigation system. After ploughing, the weeds turned over into the water are allowed to rot and new weeds are prevented from growing by the flood condition. To this end, the standing water must be constantly maintained at a depth of as much as more than 8 niu (20 cm) in every ploughed parcel. This depth of water is maintained to control weeds throughout the period of land preparation up to immediately before transplanting.

The short period of rest is followed by the first harrowing which aims to break down the lumps of soil into soft mud. And in so doing, most of the weeds are completely trodden down under the mud while clusters of the longer weeds twined round the teeth of the harrow are removed by hand. After this the plot is left again to allow weeds to die under the deep water for one or two weeks. The second harrowing, begun just before transplanting, then starts to break down and puddle the soils to make the extremely fine mud required for transplanting. By this time, the seedlings in the nursery bed must be grown up to the proper height and uprooting of them must proceed simultaneously with the second harrowing. On the day of, or the day before, transplanting, excess water is drained off the plot so as to adjust the standing water to the 4-5 niu (10-12.5 cm) deep appropriate for transplanting. Then the surface of the mud is levelled and smoothed with a bamboo pole attached across the teeth of harrow. This final step of land preparation is normally carried out in a period of a few hours or at most a day in many cases and is followed directly by transplanting.

The series of tasks of land preparation are carried out mainly by the labour force available within the individual family and co-operative labour is rarely used. One or more male members of the

household usually carry out the work throughout, which is heavy work requiring the management of a buffalo and heavy tools. Women and children render only minor assistance such as light tasks like removing weeds from the plots and mending the dikes with hoes (khǫbok) and spades (siam lua). Wage labour is not common in land preparation, but nine households did hire labourers within the village on a piece-work basis to carry out the whole process from ploughing to levelling.

(3) Sowing and Nursery Culture

In Chaingmai's transplanting culture a series of tasks in nursery preparation must proceed almost simultaneously with land preparation in the main field. The time schedule of nursery culture from seeding to uprooting must coincide exactly with that laid out for land preparation in the main field. It is widely recognised in the village that seedlings 30 to 35 days-old are most suitable for transplanting. The nursery period, therefore, roughly corresponds to the period required for preparation of 4 to 8 rai of the main plots. Nursery culture accordingly commences simultaneously with the main plot preparation on those plots of such a size range.

The tiny piece of land selected as a nursery bed or ta ka is normally at a relatively higher elevation within the operating plot. This is mainly to prevent the nursery bed from being flooded when torrential rain comes. The technique of land preparation in the nursery bed is basically similar to that in the main plot. But the duration of the work is naturally far shorter and the final step of the operation is carried out much more carefully. After ploughing and harrowing for a few days, there are labour-intensive operations of hand weeding, puddling and levelling on the mud slightly covered with water. These

tasks are usually carried out within a day by all the members of a household, in some households with co-operative labour. They all work together on a tiny piece of land with bare feet or with a hoe (khǫbok) to weed and puddle the mud. The piece of land is finally smoothed and levelled with a small wooden scraper (mai tam ta) and divided into slightly raised strips of bed 100 cm wide by shallow ditches of 30 cm wide for the purpose of irrigation and maintenance. This extremely elaborate type of nursery bed is agronomically called 'the semi-wet nursery', meaning that the fine mud of the actual bed portions has no standing water but can always be saturated with irrigation water kept in the ditches alongside.[20]

Seeds (khao chüa) of glutinous rice have usually been stored in a tall woven bamboo bin called bung[21] placed in the granary or lǫng khao since the previous harvesting. The selection of seed to be sown is carefully made by putting the seeds in an earthen jar filled with nam müang or canal water; the chaff and withered and light seeds which float to the top of the water are removed and the rest is regarded as good seed for sowing.[22] The good seed selected in this way is put in a large woven bamboo basket or kuika, which is lined with a number of tüng leaves inside, and is covered with the same leaves on top. The basket containing the necessary amount of seed for sowing is soaked in a canal close to the operating plot for three days and is then pulled up from the water and left overnight on the dike. By the morning of sowing, the seeds have sprouted with a primary root of about 0.5 to 1.0 cm. Immediately after preparation of the nursery bed has finished, the germinated seeds are transferred to a bamboo basket (piat), which is hung from the sower's shoulder by strings. The sowing of seeds is carried out normally by one or two skilled men of the operating house-

hold. Walking along the shallow ditches, they scatter a handful of seeds evenly on the mud of the beds. The average rate of seeding is 0.5 thang (10 litres) for one rai of main plot to be transplanted; this means that a quite small amount of seed is sown, if compared with Ayutthaya village where the necessary seed rates are 2 thang/rai in broadcast-sowing and 1 thang/rai in transplanting.

After sowing, the nursery bed is surrounded by a simply constructed fence made of a few bamboo bars attached to wooden poles in order to prevent buffaloes from trampling the nursery. At each corner of the nursery, a magic pentacle figure made of bamboo strips or thaleo,[23] fixed on a bamboo pole, is set up to protect the soul of the rice (khwan khao) from evil spirits. In the nursery which is thus protected by both real and symbolic fences, the water in the ditches is strictly controlled to maintain a moderately wet condition with no standing water on the sown beds, particularly for two weeks immediately after sowing. Throughout the nursery period particular care is devoted to avoid the young seedlings being drowned in excess water sometimes caused by torrential rains.

(4) Uprooting and Transplanting

Uprooting of seedlings (lok ka) and transplanting (puk khao ka) represent one of the most crucial stages of Chiangmai's transplanting culture in both the technical and socio-economic contexts. These operations, requiring many delicate techniques to deal with the young seedlings in a careful and timely manner, must be completed within a limited short period by mobilising a number of peasants on an intensive basis. Such labour-intensive operations are normally carried out in a few days immediately after land preparation in the main plot has finished

and last from early July up to late August in different plots.

When ready for transplanting, 30 or 35 days after sowing, the seedlings are about 50 to 60 cm high on their strips of seed bed which have been maintained at a moderate moisture level. These 30 to 35 day-old seedlings, specifically called ka fǫi or fine seedlings, are most favoured for transplanting in the main plots under ordinary water conditions. The operation of uprooting is undertaken by couples of men and women working together on a strip of bed. The man pulls up a handful of seedlings, smacks the roots strongly against his heel and rinses them in the water of the ditch to remove the soil. Several handfuls of seedlings are handed over to the woman who follows him and she arranges them into a bundle tied with a thinly split bamboo. The top few centimetres of leaves are cut off to a length of 40-50 cm[24] by another man who follows several couples working in uprooting and bundling. These tasks are thus skilfully and swiftly performed through the division of labour between men and women.

Transplanting is usually carried out within one or two days immediately after uprooting has finished. The bundles of seedlings piled up in the nursery bed are put in large bamboo baskets (kuika) and are hauled by carrying pole to the main plot. A number of men and women, taking a bunch of seedlings in the left hand, insert four or five seedlings onto the mud which is covered to a standing water depth of approximately 4-5 niu (10-12.5 cm). Moving backwards, they transplant seedlings at random but keeping the intervals between stands approximately 30-40 cm.

Besides the ordinary method of uprooting and transplanting, using ka fǫi, there is the alternative method of double transplanting mainly practised only in deep flooding plots, or na hong. In this double transplanting method, seedlings 15 days-old, called ka chǫm are initially

uprooted and transplanted in a part of the main plot, over an area twice or three times the original nursery bed. Thirty days after the first transplanting, the strong seedlings of 60-80 cm in height are uprooted and transplanted again all over the main plot. The double transplanting method, which is said to have been introduced in the late 1960's has now been adopted in some na hong plots of the Nǫng Plaman and Huai Sai fields where the water depth reaches more than 8 niu (20 cm). According to the peasants who adopt the method, it is said that the strong stalks of the seedlings are thus suitable for deep water, being able to withstand destructive pests such as the land crab (pu na) and water bugs (maeng da na, Lethocerus indicus) found particularly in such deep water plots.[25] However, as pointed out by Watabe, the repeated transplanting, cutting the root short and reducing the number of leaves, can help to prevent excessive vegetative growth (Watabe, 1967: 70). In any case, this extremely elaborate method of double transplanting is applied only to a limited area of na hong and only when the operating household can obtain the necessary labour force for the labour-intensive tasks of each uprooting and transplanting.

Whether the single transplanting method by ka fǫi or the double transplanting method by ka čhǫm is practised, every operating household tries to concentrate its available labour during this crucial and quite short period. Although the input of family labour is maximised in every household, it is the regular workers, together with the old people, who always perform the most substantial role in the operations which require experience and skill. Among the marginal labour units, young children usually constitute a supplementary labour force to help the working adults where necessary. It is quite usual, however, that in addition to family labour a great part of the labour input at this stage

is derived from extraneous sources. As we shall discuss in the next chapter, co-operative labour traditional to the communal village society and wage labour, mainly supplied by rural labourers, are most intensively mobilised at this stage as well as at harvest time.

(5) After-cultivation

So far as Chiangmai village's fields and adjacent areas are concerned, weeds which spring up after transplanting has finished do not seem to be of great significance. In the period after transplanting, the plots here are less troubled by weeds than is the case in Ayutthaya, whether the fields are broadcast-sown or transplanted. The peasants usually give the following reasons for this. First, the elaborate land preparation techniques, particularly the repeated harrowing with the considerable interval of deep inundation, greatly contribute to prevent weeds growing after transplanting. Second, the maintenance of relatively deep water in the plots serves to kill off most dryland weeds, leaving only some aquatic species. This is true particularly during the period from September onwards when most plots become filled with standing water of more than 8 niu (20 cm) depth due to increasing rainfall. Third, the practice of burning straw and stubble which remains after harvest, which is called phao füang, has the effect of destroying the seeds of annual weeds and the creeping root systems of perennial weeds.

All these practices, whether consciously or unconsciously carried out, certainly seem to serve the purpose of prevention against the weed problem as a whole. Some weeding is carried out in many plots, particularly within four or five weeks of transplanting. The peasants merely, however, trample weeds under the mud while they are making

their observations of the water level and of the growth of the young plants. Such weeding is therefore incidental and takes place only during that period,and most plots are left almost untouched thereafter other than the conscientious regulation of the water level. Herbicides and pesticides, which have become increasingly prevalent in Ayutthaya and elsewhere in the delta, have yet to be applied in Chiangmai's main season cultivation.

In the village the peasants have long made use of farmyard manure or pui khǫk, but few have sufficient cattle or buffalo to produce large quantities. In 1974, only fifteen out of 112 total operating households then still applied their home-made or purchased manure to the main season fields before transplanting. In addition to farmyard manure, chemical fertiliser, which was introduced around 1970 along with improved seed varieties of the RD series, has recently begun to be applied, in limited quantities, to native varieties in main season cultivation. The chemical fertiliser applied by 12 households in 1974 was exclusively ammonium phosphate,[26] a government recommended fertiliser, which is imported and can be purchased from the agricultural co-operative and shops at Mae Rim town. Peasants apply only a small amount of this fertiliser, about 7 kg/rai on average, between 15 and 45 days after transplanting when the young plants are taking root in the tillering stage. Those who use fertiliser or manure are mainly the cultivators of their own holdings and in the few cases of tenants making such applications, the landlords normally pay the cost.

Apart from weeding and application of fertiliser, every household's primary task thoughout the period after transplanting is the control of water in the plot. The peasants consider that the standing water should constantly be maintained 'as deep as the width of the human palm' (nam

lük fa mü), or approximately 4 niu (10 cm) for at least 4 to 5 weeks following the transplanting operation. Particularly in the first few weeks of the period until the plants take root, the peasants are extremely careful to protect them from being drowned. They make frequent careful inspections of their plots, make repairs to the dikes and control the level of standing water by regulating the farm turnout and bamboo conduits whenever necessary. However, after this critical tillering stage, the plants enter the generative growth period and such strict water control is not required. From mid-September onwards every plot tends to become flooded more deeply to as much as 8 niu (20 cm) in the ordinary plots and occasionally up to 1 sǫk (50 cm) in some na hong, due mainly to the continuous rains. At this time the peasants show the greatest concern over flooding. Drainage of excess water from the plots is carried out, but sudden flash flooding is completely beyond their control.

All these tasks of weeding, fertiliser application and water control are carried out mainly by household labour. Co-operative labour and wage labour are rarely used in this period. These tasks, particularly in water control, normally do not require the intensive labour input of transplanting or harvesting, but only continuous and regular observation of conditions and light tasks of short duration.

(6) Harvesting

In most cases 20 or 30 days before harvesting starts, the standing water is drained off from each plot, following the shutting down of the main regulator of each müang fai system in November. In the 1974-75 cropping season, harvesting continued from 17 November to early January in different plots according to the maturation time of the different

rice varieties. Among the early varieties, moei nǫng in particular, which is cultivated in the terraced plots of the Mae Raem field, must be harvested within November for fear of a sudden fall in temperature. Dǫ daeng, the other early variety which is adopted widely over the four main fields and which has the greatest popularity for subsistence begins to be reaped in late November. The harvesting of san patǫng, a locally improved medium-term variety suitable for better irrigation conditions, commences from early December. This is then followed by harvesting of other medium-term and late varieties, with the lai ton kham and lai pi, grown in the deep water na hong, bringing up the rear in early January. It should be noted that these varying harvest times were deliberately planned from the beginning when seed selection was made by each household according to the different ecological conditions of the operating plots, the home consumption needs of the family and the possible diversification of labour necessary for harvest.

By harvest time the plot is completely dried up and the stalks of paddy are normally erect, though some of the late varieties may have become lodged and lay prone on the ground. The stalks are cut off at about 2 sǫk (100 cm) from the ear leaving stubble of 20 to 25 cm. The sickle used in harvesting has a slightly curved blade which is skilfully designed to suit the cutting of such a length of stalk.[27] The relatively long cut stalks are also suitable for the threshing motion of beating a bundle of stalks on the threshing floor. Too long stalks can, however, cause an inconvenience for haulage by carrying pole.

Since harvest must be finished within a period of only a few days, each household tries to maximise its input of labour, as at the stage of uprooting and transplanting, by mobilising co-operative labour and wage labour, as well as all available family labour. Besides the

regular farm workers of the household, old people and even school-age children are assigned to perform lighter tasks. In most households, however, the greater part of the harvesting operations is normally carried out by labour resources from outside the family. In particular, co-operative labour continues to have an important role in the operations, as we shall see later in the next chapter.

(7) Drying, Bundling and Hauling

The harvested stalks are left on the ground to dry out in the sun for 3 or 4 days. Since most plots are completely dried up after the drainage of irrigation water, there is no fear of the stalks being wet, in contrast to Ayutthaya's deeply flooded fields where a late subsidence of the inundation water frequently poses obstacles for drying the harvest. After drying in the fields, three or four handfuls of stalks are bundled together (mat khao) with thinly split bamboo and are left to dry again for a few days. The bundled stalks are then hauled by carrying pole or khan lao hap khao to the threshing floor ready for the start of this operation.

For these tasks the regular farm workers are again usually supplemented by co-operative labour and wage labour, to a considerable degree, so that a great amount of stalks can be dealt with within a limited period. In recent years, wage labour has become more prevalent particularly in the bundling operations, and conversely the traditional utilisation of co-operative labour seems to have declined. Most households are far less dependent on co-operative labour than at the transplanting and harvesting stages.

(8) Threshing, Winnowing, and Hauling

The final stage of operations in Chiangmai's transplanting culture consists of threshing, winnowing and hauling produce to the granary. The operations of threshing and winnowing take place exclusively on a threshing floor or talang (talang ti khao) prepared on a relatively higher and completely dried part of the operating plot. None of the production processes of rice cultivation are carried out in the compound of the farm house in Chiangmai village. While drying and bundling are proceeding, the preparation of the threshing floor must be completed by one or two members of the household. A piece of dried land of around 5-10 wa (10-20 m) square is cleared and the remaining stubble and leaves are completely removed. After being soaked with water for a night it is trampled over with bare feet or by a buffalo to smooth it and then levelled with a wooden scraper (mai tam ta). After the floor has been left to dry for half a day, buffalo manure, in many cases purchased from buffalo raising households, is mixed with water and spread over it to fill up the surface completely. Thus a piece of ground which may be uneven or cracked can be improved, after which it is left to dry for about four days before being ready for threshing. This technique for preparation of the threshing floor is quite similar to that which prevails in Ayutthaya village and elsewhere in both Intermontane Basin and Delta farming regions.

On the threshing floor thus prepared, the threshing operations or ti khao usually start at 6 or 7 pm in the cool evening air and last up to midnight. Several men and women, including wage labourers, hold a bundle of sheaves over their head and beat it down on the floor to thresh out the grain. To hold it they preferably use a holder called mai hip khao, which is made of two bamboo sticks 60 to 80 cm

long with a string of 50 cm connecting the ends. Each bundle is threshed by beating twice or three times and then the grains still remaining on the sheaves are finally removed by beating with a sort of broom made of coconut palm fronds (dǫk bapao). The threshed grains are gathered up, using a wooden scraper, into a pile on the floor.

The winnowing operation (fat khao) may take place on the same floor the following morning, mainly carried out by family labour. The traditional method of winnowing with a couple of fans is still predominant, as commonly practised in most of the Intermontane Basin farming region. No winnowing machine, whether hand-driven or power-driven, which has been quite popular in the Delta for many decades, can be seen in Chiangmai village. Instead while one man tosses the grains up to about 4 m high from the ground using a wooden spatular or phak čho khao, two other men or women with a couple of winnowing bamboo fans (kawi khao) make a wind to fan away chaff and dust from the falling grains. This simple method of winnowing is repeated many times until the grains are satisfactorily cleaned.

The grains of paddy thus cleaned are ready for storing or disposal. Before the produce is carried to the household rice barn, in the case of tenants, this is the time to measure the total production by use of a measuring bin containing 20 litres (thang tuang khao) and to pay the rent in kind to the landlord on the spot according to the previously contracted rate. The landlord's share is customarily hauled to his granary by the tenant first. He can then haul the rest to his own rice barn by his own or hired ox-cart. In his farm compound, he then completes his payments in paddy, as well as those in cash, of buffalo rent and of wages to the rural labourers and others who lent him a hand in various stages of cultivation. In most cases of share-

cropping or yia na pha koeng, the tenant, may have to pay as much as half his total production after deducting buffalo rent and seed requirement. Such a procedure after winnowing has finished is basically the same in all categories of operating household.

Throughout threshing and winnowing the regular farm workers of the household are always at work and its marginal labour is also effectively mobilised in casual tasks. It is, however, most characteristic at this stage that most households hire a number of young people of about 20 years of age, particularly for threshing. The operation has long been carried out almost entirely by these younger people, hired on a cash basis, and co-operative labour, which is still actively utilised at other stages, performs here only minimal function. These young men and women called dek čhang ti khao, or 'minors hired for threshing paddy'[28] are normally provided food and drink, in addition to a wage in cash, by the host household. This particular form of employment which is practised only in the threshing operation has also particular social implications. The threshing operation lasting till midnight seems to be not just work but a special time and place for the mixing of work with social intercourse, particularly courtship, among the young participants. On every plot it is possible to detect a festive nature to the threshing which brings to an end the year-long process of cultivation. To this particular form of labour utilisation and its social implications we shall return in Chapter VIII.

3. Broadcast-sown Cultivation in Ayutthaya Village

As we have already seen in an earlier section, broadcast-sowing is overwhelmingly predominant throughout the Tontan field, except for a small area of early season cultivation using transplanting introduced

in the early 1970's. In Ayutthaya village and the adjacent areas in the Retarding Basin of the delta, broadcasting has been almost the only feasible method of cultivation throughout history, and the technology of broadcast-sowing practised in the village since the turn of the century is basically similar to that prevalent throughout the Delta farming region, though variations in detail are observable. In the ecological and technical context of the Chao Phraya delta, it can be characterised by the cultivation of late varieties of rice by direct sowing, mainly dependent on monsoon rainfall during the first half of the cultivation period and subsequently upon inundation. It also tends to be practised as an extensive method of cultivation over relatively large operating areas.

This method of cultivation is thought to have been applied, alongside the transplanting method, in considerable parts of the upper delta throughout the Ayutthaya period (1350-1767 A.D.). During the seventeenth centry, some contemporary sources in western, Chinese, and Japanese languages recorded broadcast-sowing around Lopburi and the capital of Ayutthaya.[29] Taking into consideration the physiographic and hydrological conditions, it can be safely assumed that both methods of cultivation were equally prevalent over the upper delta, the Depression Belts and some parts of the Old Delta Proper up to the mid-nineteenth century. The rapid and large-scale expansion of broadcast-sown fields or na wan, however, appears to be a result of the reclamation boom since the late nineteenth century. It is worth noting that broadcast-sowing cultivation is not a primitive form of rice culture but a highly efficient and rational form of adaptation to the deltaic environment exposed to uncertainty of rainfall and inundation. With a relatively less labour-intensive nature and a relatively low degree of

land improvement, it has remained quite popular as one of the most efficient forms of peasant technology up to the present.

Since it has been practised for many centuries, rice cultivation in the Delta region has a rich technology. According to the traditional classification, there are two major categories: na suan, or literally garden rice field, and na müang, or local rice field.[30] The na suan field was normally cultivated by transplanting under favourable water conditions and na suan rice was believed to be of better quality and especially suitable for export (Child, 1892: 146; Suvaphan, 1927: 2-3). The na müang field was cultivated exclusively by broadcast-sowing mainly in low-lying areas subject to prolonged deep flooding. Having a shorter grain and being inferior in quality for export, na müang rice is likely to have been mainly assigned to domestic consumption and a great many people actually prefer it to na suan rice (Suvaphan, 1927: 6).

This classification of riceland, however, has recently fallen into disuse. The old terminology has been commonly replaced by more appropriate agronomical terms: na dam or transplanted field and na wan or broadcast-sown field, both of which are directly suggestive of the respective cultivation methods (Graham, 1924: Vol.2, 9). The peasants in Ayutthaya village also often speak of na fang lǫi in favourable terms to indicate their broadcast-sown fields, as distinguished from na dam practised in the small portion along the Khanomčhin canal. The na fang lǫi, which literally means the field of floating paddy stalks, originally derived from a legal term for riceland taxation in the pre-modern period. As many historical materials suggest, na fang lǫi was newly exploited riceland on which the riceland tax (kha na) was levied only when the area was actually cultivated during the year, while na khu kho, the first grade riceland under continuous cultivation was

subject to payment for the entire area whether it was operated or not.[31] This pre-modern classification is rarely used in application to the present riceland. Only the word na fang lǫi is still alive to imply the traditional broadcast-sown fields of the village, though it has no longer legal implications, but just means na wan as distinguished from na dam.

In the village context three terms, na müang, na fang lǫi and na wan, can all still be heard, signifying broadcast-sown plots among peasants, though the use of na müang is beginning to disappear.[32] Despite the fact that these terms imply different ways in which broadcast-sown fields are distinguished from transplanted fields, at present they all signify the broadcast-sown field itself, in which the traditional technology has survived under the almost immutable conditions of the delta.

(1) Selection of Varieties

All varieties grown in the broadcast-sown fields of the main season are without exception indigenous photoperiod-sensitive non-glutinous varieties with a quite long duration of growth varying between 170 and 250 days, as shown in Table 35. In contrast to Chiangmai village, the peasants concentrate only on non-glutinous rice both for sale and for home consumption. These varieties all have high photoperiod-sensitivity and, in particular, three popular varieties which are harvested from January through to early February are considered to have extremely high sensitivity. Since they have fixed dates of flowering and ripening, every peasant is always aware of the approximate harvesting period of each variety. Regardless of a considerable range of sowing period (1 May - 1 August) owing to the uncertainty surrounding

TABLE 35: Rice Varieties in Ayutthaya Village, 1974-75

Traditional classification	Name of variety	Harvesting date in 1974-75	No. of plots for primary choice*	Approximate duration of growth
khao fang lǫi or khao na müang				
khao kün nam (floating rice)	pin kaeo	Jan 25 - Feb 5	2	230-250
	phuang nak	Jan 5 - Jan 20	23	210-230
	sam luang	Jan 1 - Jan 15	1	210-220
	phuang klang	Dec 20 - Dec 31	17	190-200
khao mai khün nam or khao kiao kan nam (non-floating rice)	phuang bao	Dec 10 - Dec 25	2	170-180
	kami	Dec 10 - Dec 20	2	170-180
	khao ta haeng	Dec 10 - Dec 20	3	170-180
	hǫ met lek	Dec 10 - Dec 20	1	170-180
	luang chaek	Dec 10 - Dec 20	1	170-180
Total			52	
Improved variety for early season cultivation	kǫ khǫ nüng (RD1)	Jul 1 - Sep 11	12	120
	si si (C4-63)	Aug 10 - Sep 5	3	120
Total			15	

* The total numbers of households surveyed are 43.

Source: 1974-75 Survey.

the onset of the monsoon rainfall, the date of harvest of these varieties can be forecast accurately. Through selection of the variety, the peasants thus are able to anticipate the date of harvest and set a time schedule for the entire course of cultivation, in the same way as practised in Chiangmai village.

Ayutthaya's peasants, as in the case of Chiangmai and elsewhere, though not so frequently, refer to a threefold classification of seed variety: khao bao (early variety), khao klang (medium-term variety), and khao nak (late variety). However, this type of classification is essentially a relative and local one, all the varieties having such a late maturation time as to be uniformly termed 'late varieties' and some of them could even be termed 'extremely late varieties' by reference to all other varieties cultivated in this country.

On the other hand, there is another twofold classification frequently found among the peasants of Ayutthaya village, this with respect to the growth habit of seed variety. This classification divides the rice into: khao khün nam or 'floating rice' and khao mai khün nam or 'non-floating rice'.[33] Four varieties with extremely late maturation time are here identified as khao khün nam, while others are khao mai khün nam.

As noted in much of the agronomical literature, 'floating rice' grows, at the internodes of the plant, to keep pace with the rising inundation, and its stem may attain a length of up to five or six metres in order to keep the tip of the plant above water.[34] Khao khün nam has a striking habit which leads to its name of fang lǫi or floating paddy stalks, growing as it does in a rather zigzag fashion under the water and with its tip and some leaves lying on the surface. The growth rate of

internodes attains about 5 cm per day, and sometimes 10 cm per day is recorded (van der Heide, 1903: 47; Grist, 1975: 141; Kaida, 1978: 241). According to the peasants' observation of the plant, khao khün nam must have at least four leaves including the uppermost leaf, or bai tat hang plathu (leaf of halved thu fish tail) always remaining above the rising level of the flood water.[35] These striking habits of khao khün nam and its associated cultivation methods were already vividly recorded in Japanese and Chinese sources of the seventeenth century onwards for the deep inundation areas around the city of Ayutthaya.

On the other hand, hao mai khün nam cannot survive in extremely deep inundation, for its panicle is submerged under water. These non-floating varieties are also called khao kiao kan nam, or rice to be harvested in the water, because they must be harvested in the still inundated fields, even using boats, before flooding subsides completely.

The twofold classification of khao khün nam and khao mai khün nam (or khao kiao kan nam), though being a local one, is effective in indicating the water conditions needed for the different varieties. Four khao khün nam varieties with floating habits and extremely late maturation time are adopted in most of the area of the Tontan field which is subject to prolonged deep flooding; in the 1974-75 cropping season 35 out of 43 households operating broadcast-sown plots made these four varieties their first choice, as shown in Table 38. In particular, phuang nak and phuang klang, to be reaped in January and late December respectively, have been most popular for many decades, mainly due to their stable yields on the plots with the deepest inundation water. In these plots water shortage in the first half of the cultivation period and deep water in the latter half are such crucial conditions that the peasants have no alternative but to select

the khao khün nam varieties. Early harvesting which may enable the peasants to dispose of their product to the market or to secure their home consumption rice earlier in the season seems to be absolutely impossible.

On the other hand, 8 out of 43 households had khao mai khün nam varieties as their first choice in slightly more elevated plots where the water level is not so deep throughout the cultivation period. These varieties, which normally attain moderate and stable yields similar to those of khao khün nam, are adopted mainly for their earlier harvesting time in early to middle December. Despite the fact that the peasants must harvest these varieties before the flood water is completely drained, they are planted in rather elevated areas. Nevertheless, they seem to offer attractions to the peasants who are tempted to obtain earlier harvests. We have to note, however, that the khao mai khün nam varieties can be adopted successfully only within a limited number of plots close to the Khanomčhin canal.

It is thus obvious that the selection of seed varieties is primarily and strongly governed by water conditions, above all the depth of inundation water, varying between 70 and 170 cm deep. In addition to this extremely vital factor, selection of varieties also takes into consideration the balance between market disposal and home consumption. In contrast to Chiangmai village, the 44 operating households of Ayutthaya village all sold the greater part of their paddy production after the harvest of the 1974-75 cropping season. Out of this number 34 households were also able to reserve some proportion of their home consumption needs, the rest disposing of their whole product on the market immediately after harvesting, leaving only a small quantity for seed for the next year. The latter are mostly tenant households who

are compelled to do so in order to obtain cash income to meet the increasing expenditures including land rent and debts, and as a consequence they have to purchase milled rice for daily consumption throughout the year as in the case of most rural labourers. In general, not only the tenants but most operating households seem to be inclined to sell their products as early as possible, mainly in January, in order to complete payment of their production costs and to obtain cash for consumption expenditure. Only a few households operating larger holdings are able to store a part of their production for sale at later stages when prices are rising, mainly in April and May.[36]

Under such circumstances many households tend to select, in addition to their first choice variety, one of the khao mai khün nam varieties as second choice for a smaller part of the holding, unless it is located entirely in the deepest depressions. The plots near the Khanomchin canal contain, in many cases, both depressions and relatively elevated portions where inundation water normally reaches less than 120 to 130 cm deep. This is partly because a single plot extends over a broad area, and partly because the land is insufficiently levelled, thus allowing varying elevation within a single plot. In these plots the peasants may deliberately select a second variety of khao mai khün nam for a smaller portion of the holding, with the expectation of earlier harvest in December, while the other larger portion may be put under their first choice variety of khao khün nam for later harvesting in January. The harvest of the former may be first put on the market in January in response to an urgent need for cash income, while the latter may be sold subsequently. Thus, Ayutthaya's diversification, which is basically derived from risk aversion and labour spread in the harvesting time, has a strong relation to the ecological conditions of each

operating plot. The diversification technology based on different maturation time is apparently similar to that practised in Chiangmai village where it primarily aims at providing subsistence during the period of food shortage. In Ayutthaya village, however, it also relates to some extent to considerations of earlier market disposal of production under the increasing necessity for cash in the household economy.

Given the long involvement in the rice market economy, the rice produced by Ayutthaya's peasants has always had two ends: as a commodity with exchange values, or khao khai (rice for sale) and as rice for home consumption with use value, or khao kepwai kin. As a market commodity, in general, the broadcast-sown varieties used in the village are not of particularly high market quality. However, the peasants well know that in order to secure stable yields under the existing water conditions, they have no alternative but to select the khao khün nam and khao mai khün nam for ecological reasons. On the other hand, the cooking and eating quality of these varieties is said to be fairly satisfactory for daily consumption. As we have seen earlier, however, some operating households, mainly tenants, have become unable to reserve any of their own khao kepwai kin, disposing of the whole product immediately after harvesting. For them, the rice they produce is nothing more than a market commodity.

(2) Two Types of Land Preparation and Sowing

In Ayutthaya village, broadcast-sowing can be divided into two types according to land preparation and sowing closely related to the water conditions in the plots at the beginning of the rainy season. In the dry field plots, the dry sowing method, or samruai, is employed,

while in puddled plots where there is access to water, the wet sowing method, or phǫloei, is to be found.[37] The samruai method is usually practised by sowing the ungerminated seed on the plots in which the soil is adequately moistened during the preliminary ploughing period. The area adopting this method is quite large, amounting to 85 per cent of the total cultivated area (Table 33). Atlhough the phǫloei fields are also broadcast-sown, their appearance resembles paddy fields cultivated by transplanting. This is because the germinated seeds are sown in puddled plots resembling the nursery bed of transplanting. In many cases, because phǫloei plots are in low-lying swampy land, the plots are in a flooded condition during land preparation in April and May. The plots in which the phǫloei method is employed occupy only five per cent of the total area operated.

Figure 34 is a cross-section from the Khanomchin canal to the Rang Khok, showing the relationship between the distribution of the two types of cultivation and the local relief. From the area of elevated levee along the canal, the terrain gradually slopes downwards towards the Rang Khok with some depressed pockets. Apart from the transplanting plots stretching no more than 200 m away from the canal bank, the samruai plots are predominant throughout the entire area, but everywhere there are phǫloei plots scattered in depressions where the level of ground water is relatively high and where puddles can be seen in the early and late rainy season. In many cases, a kind of reed, kok samriam (Cyperus digitatus) grows in such depressions.[38] These depressions provide good bathing places for buffaloes during the period of water shortage, and during the period of flooding in the rainy season they function as drainage channels.[39] The depth of water in November is around 100-130 cm on the samruai plots, while it attains 150 cm or more

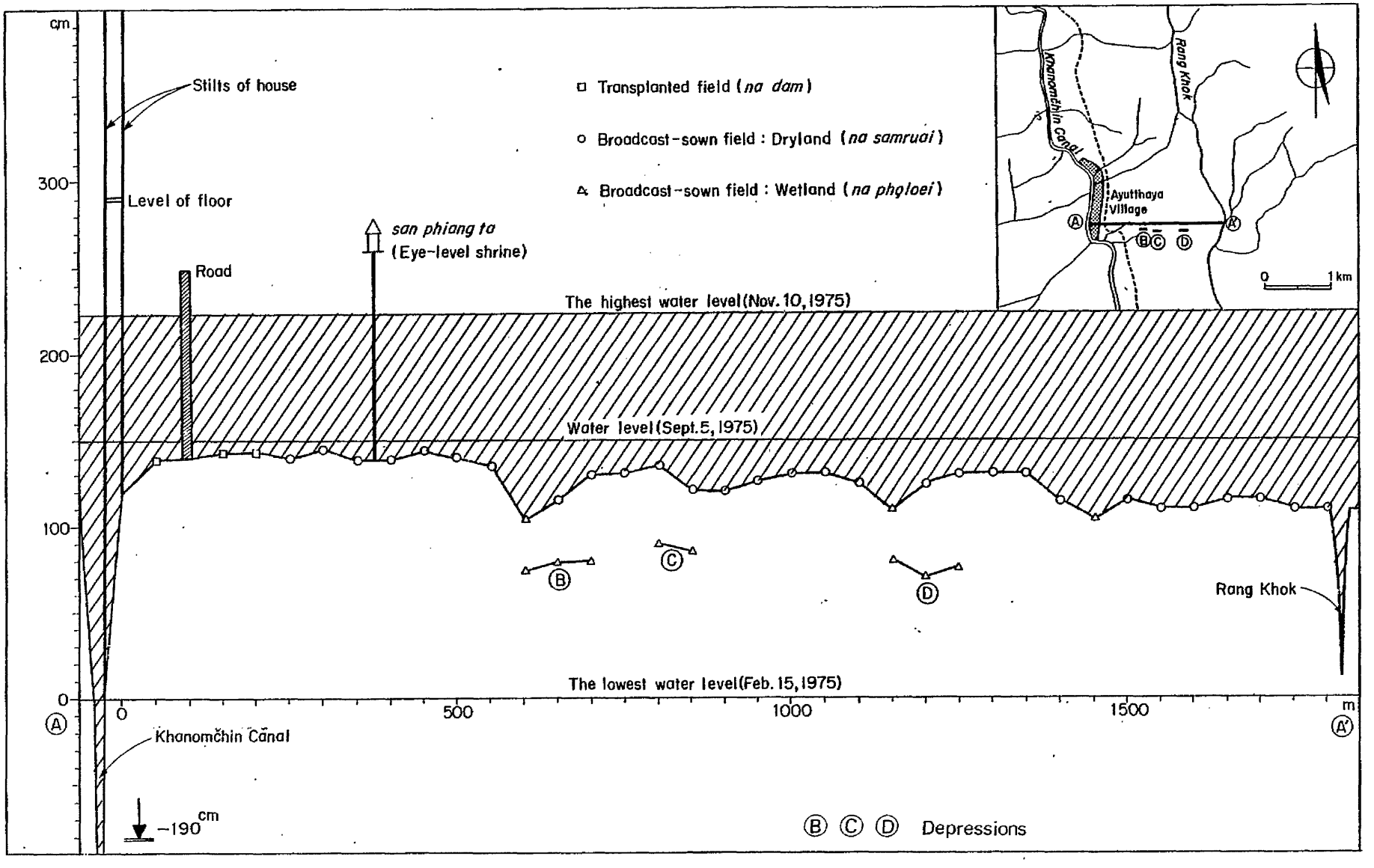


Figure 34: Local Relief and Type of Cultivation in the Tontan Field

in some depressions of the phǫloei plots.

(3) Land Preparation

For both samruai and phǫloei methods the first rains are awaited and ploughing commences traditionally using a wooden plough drawn by one or two buffaloes.[40] Buffaloes have provided the motive power for a long period, but since the late 1960's farm machines have increasingly been in use while ploughing with buffaloes is now disappearing. As shown in Table 36, though power devices such as tractor and power tiller are widely used in land preparation, buffalo ploughing was still practised by a considerable number of households in the 1974-75 cropping season. As none of the villagers owns a large tractor, mechanised ploughing is done by tractors hired from villages in the same district and even from as far as Amphoe Bang Pa-in to the south-east. In normal cases, the large tractors are hired on contract to plough a specific area. In addition to large tractors smaller power tillers are coming into wide use and are owned by several households.[41] Large tractors are employed only when extensive areas of samruai plot have to be prepared. The smaller devices, by contrast, can be utilised at every stage of land preparation and even in puddled plots for phǫloei broadcast-sowing and for transplanting. The recent use of machinery in land preparation greatly helps to shorten the period of ploughing; a tractor can cultivate a one rai field in half an hour and a power tiller in an hour,[42] while buffalo ploughing takes a whole day or approximately six or seven hours work for the same area. Moreover, tractor and power tiller ploughing enable the peasants to begin cultivation earlier than the traditional buffalo ploughing. Peasants relying on buffalo must wait for the first monsoon rainfall to soften the solid surface of the

TABLE 36: Methods of Land Preparation in Ayutthaya Village, 1974-75

Type of cultivation	Rough-ploughing cross-ploughing	Cover-ploughing	Harrowing levelling	No. of plots*
Broadcast-sowing method				
samruai (Dryland sowing)	Buffalo	Buffalo		13
	Tractor	Buffalo		13
	Tractor	Power tiller		1
	Power tiller	Buffalo		2
	Power tiller	Power tiller		14
phǫloei (Wetland sowing)	Buffalo		Buffalo	4
	Power tiller		Power tiller	5
Transplanting method	Buffalo		Buffalo	5
	Power tiller		Buffalo	2
	Power tiller		Power tiller	8
Total				67

* The total numbers of households surveyed are 43.

Source: 1974-75 Survey.

clay soil before ploughing is possible. Power devices, however, need not depend on the unreliable rainfall, and can be used to start land preparation at any time.

In buffalo ploughing of the samruai plots the traditional task of land preparation is divided into three parts: the rough-ploughing (thai da), cross-ploughing (thai prae) before sowing, and the cover-ploughing (thai klop) to cover the sown seeds with soil.[43] The rough-ploughing is done so as to throw up the soil in ridges and weeds which are turned over are allowed to rot and fertilise the soil. After rough-ploughing the plots are left alone, normally for two weeks, but occasionally for four or five weeks, and are then cross-ploughed in order to turn the ridges over again. If done by draught buffalo for both ploughings, the plots must be moistured by rainfall and are normally ploughed to an average depth of 4 niu (10 cm), driving the buffalo round to the left. The depth ploughed is almost the same as attained by buffalo ploughing in Chiangmai village. The main purpose of both ploughings is to simultaneously weed and loosen up the soil. The long interval between rough-ploughing and cross-ploughing can be regarded as one of the major means of weeding in the land preparation stage. However, it appears not to be very effective under the conditions in which the plots are, in most cases, not submerged due to the still inadequate rainfall at this period. Moreover, harrowing, or khat, which is still commonly observable elsewhere in the Delta farming region,[44] has recently fallen into disuse in the land preparation stage of most samruai plots. Again, there are some plots where the cross-ploughing, traditionally done before sowing, is now omitted. This seems to be mainly because of the recent introduction of weedkillers since the early 1970's, removing the need for these traditional weed controlling

practices in land preparation.

The land preparation of the phǫloei wet sowing plots starts with ploughing in the puddled soil. Under this method, because of flooding at the beginning of the rainy season, large tractors cannot be used and buffaloes or power tillers are used instead. From ploughing through harrowing to levelling, the land preparation of the phǫloei method is the same as that for transplanting. The rough-ploughing is done in plots on which the water depth is kept at approximately 3-4 niu (7.5-10 cm). Since the standing water restrains weeds from growing, cross-ploughing is often omitted in these phǫloei plots. This is followed by harrowing twice or three times in order to remove weeds and break down lumps of clay, so as to obtain a fine mud three or four days before sowing. On the day of sowing, after water is drained off by scooping baskets (chong long) or power pumps, the plots are harrowed until level. After this, the surface is finally smoothed with a log of 1.5-2.0 m attached to the harrow and some small ditches are made in order to facilitate drainage.[45]

In both samruai and phǫloei methods of land preparation, the number of working days per unit area have recently been reduced mainly due to the wide prevalence of mechanised ploughing and partly to the introduction of weedkillers. In buffalo ploughing the average time of operation is 1.2-1.8 days/rai for samruai plots and a maximum of approximately 2.0 days/rai for phǫloei plots, which represent a considerably lower labour intensity, compared to the 2.6 days/rai in Chiangmai's transplanting culture. This indicates that the traditional operations of land preparation in Ayutthaya's broadcast-sown fields are of lower labour-intensity so as to complete the cultivation of a relatively large area. Like Chiangmai's peasants, regular farm workers,

mostly the men within a family, are mainly responsible for the tasks in land preparation, and wage labour has not been popular at least in traditional buffalo ploughing. Against this traditional pattern of labour utilisation, however, the recent farming mechanisation has brought about a significant change. Since large tractors hired from outside the village are driven by a tractor's owner on a piece-work basis, the operating households leave the work to him. Smaller power tillers owned by peasants inside and outside the village are also widely hired either on a piece-work basis or without the services of an operator. All these recent practices of mechanised land preparation not only reduce the input of domestic labour but result in an increasing cash outlay in production as seen also in the later stages of cultivation.

(4) Sowing

In samruai plots a peasant has to be ready for sowing while the cross-ploughing is in process. Although when seeds are sown the surface of the soil may be quite moist, puddling is not suitable for the samruai sowing. Ungerminated seeds kept since the previous harvest are put in a woven bamboo basket (krabung), which is hung from the peasant's shoulder by strings. He walks forward, throwing up a handful of seed in the air. The average rate of seeding is two thang (40 litres) or about 20 kg per rai (125 kg/ha); this is four times the rate of Chiangmai's transplanting method and twice that of transplanting in Ayutthaya. This figure thus represents a quite high rate of seeding, even when compared with the same dryland sowing in other countries.[46]

Immediately after sowing, or at least within a few days, cover-ploughing is performed to turn the seeds under. Some peasants harrow the sown plots as a substitute for cover-ploughing. These operations

after sowing are usually done by buffalo or small power tiller, even though a large tractor may have been used previously in preparing the land in the same plot. A large tractor would be too heavy to do such a delicate task after sowing.

In phǫloei plots, on the other hand, sowing and related operations are apparently similar to those of nursery culture in the transplanting method. Three days before sowing, seeds are soaked overnight in water contained within an earthen jar (ong) and are then transferred to a woven bamboo basket (krabung) or round bamboo crate (kheng) covered with straw and kept in a cool place for two days. After being sprinkled with water twice a day, the seeds sprout with a primary root of about one centimetre and are then ready for broadcast-sowing. The germinated seeds carried in a krabung are sown on the fine mud already prepared with the sower moving carefully backwards. The average rate of seeding is two thang (40 litres), the same rate as under the samruai method.[47] As in the case of the nursery bed, the water level in the phǫloei plots must be carefully controlled. In particular, for about ten days immediately after sowing, water should be kept off the phǫloei plots. When the water level rises because of rain, the peasants must quickly drain out the water. After the plants take root, their survival in flood water is assured and the plots may be left alone to be exposed to the encroaching inundation from August onward.

It is obvious that the tasks of sowing in Ayutthaya's broadcast-sowing culture, whether by samruai or by phǫloei method, require less concentration of labour than in any transplant culture in which the laborious nursery culture must be practised. In most cases sowing can be accomplished within one or two days, though continuous care is required in the phǫloei plots. If any particular skill is required in sowing,

the most important may be to adjust the timing of sowing to the coming monsoon rains, especially in the dryland sowing of the samruai type. All the tasks in and after sowing are generally accomplished by regular household workers, both men and women, and wage labour is rarely seen at this stage.

(5) After-cultivation

After sowing the typical broadcast-sown plot receives little attention, apart from some weeding. Although some weeds are turned over and left to rot during the land preparation stage, every plot becomes full of various kinds of weeds a few weeks after sowing.[48] Traditionally removal of weeds has been carried out by hand in the period up to mid-August by which time the plants have rooted strongly. During hand weeding, peasants sometimes replace the young rice plants if they discover thinly planted portions of the plot, transplanting young plants from more densely growing areas.[49] Although hand weeding is still occasionally practised, weedkillers are now widely applied in both broadcast-sown and transplanted plots. In 1975, herbicides were used by 36 households or 82 per cent of the 44 operating households of the village. Peasants can purchase herbicides from Ban Phaen Agricultural Co-operative or from suppliers at Ban Phaen, and can easily apply them to the fields with a sprayer. Application of herbicides is normally made immediately after the young plants take root in July or August, and seems to lighten the task of hand-weeding to a certain degree.

In addition to herbicides, pesticides have recently come into use in the broadcast-sown plots. Especially popular are pesticides to control land crabs (pu na) which inflict serious damage on young plants.[50]

Although peasants cultivating transplanted plots are familiar with the application of fertilisers, the use of fertiliser was not observed in either samruai or pholoei broadcast-sown plots. As widely observed in the Chao Phraya delta, application of fertilisers is in fact impossible in broadcast-sown fields subject to deep flooding. The recent widespread use of industrial outputs such as herbicides and pesticides very probably began in 1970 or 1971, together with the introduction of improved rice varieties for early season cultivation.

In broadcast-sown plots, aside from these tasks in application of herbicides and pesticides, little is done for a long period until harvest time when the flood water subsides in December. All the tasks of weeding and pesticide application are normally carried out within a few days in July or August by regular household workers.

(6) Harvesting

By harvest time, in December, January and early February, most of the paddy stalks exhibit lodging.[51] Ayutthaya's landscape in harvesting season is quite a striking one in which the extremely long stalks, reaching sometimes more than 5 m, fall one upon another on the low-lying fields as far as the eye can reach. In the 1974-75 cropping season, harvesting continued from 5 December up to early February. Although the sluice-gates at the mouths of Khanomčhin canal are opened to facilitate drainage of the Tontan field, water still remains in many plots until the end of December. Thus, some varieties of khao mai khün nam (or khao kiao kan nam), which ripen in December, must be harvested in the water, using boats for hauling harvested stalks. This is followed by harvesting of varieties of khao khün nam or 'floating rice' in the almost dried plots.

The stalks are cut off at an extremely high point about one sǫk (50 cm) from the ear in a scooping motion with a deep curved sickle peculiar to the Delta region.[52] It is said that such short stalks can easily be carried on a pole (khan lao). In floating varieties and other late varieties with a strongly pronounced shattering habit, even a light contact with the ground will cause the grains to fall. As far as the harvesting technique is concerned, there is no basic difference between the samruai and phǫloei methods.

In the course of broadcast-sown cultivation, the single labour peak demand comes at harvest. This is in contrast to the transplanting method, where there is another labour peak at uprooting-transplanting stage. In order to meet the intensive labour demand in harvesting a relatively large area, most households must depend on outside labour resources to supplement the domestic labour supply. In addition to the regular household workers, old-aged people and school children in the household tended to be utilised, at least until the late 1960's, but they have recently become substituted almost completely by wage labour. Traditional co-operative labour has also declined significantly in strength, with a few exceptions practised between close kin groups, rather more rapidly than elsewhere in the Delta farming region, having been mostly replaced by wage labour since the late 1950's. As will be shown in the next chapter, labour mobilisation at this crucial stage of Ayutthaya's broadcast-sowing culture currently exhibits a striking contrast to that in Chiangmai village where co-operative labour arrangements still have a significant role.

(7) Drying, Bundling and Hauling

The harvested stalks are usually left on the ground to dry out in

the sun for two or three days. Where the ground is still wet, the stalks are carefully laid on the lodged stubble to dry. Harvested and dried in the sun, the paddy stalks are then normally bundled with dried leaves of kha (Imperata arundinacae) in the plot where stalks are left to dry. In some plots which are still wet, there is, however, nowhere to dry and bundle in the plots. Particularly in the case of khao mai khün nam harvested in water, the cut stalks have to immediately be hauled by boat to dry ground in the farm compound. In normal cases, the bundled sheaves are set over carrying poles (khan lao) and brought out to the roadside by male peasants. These sheaves are then taken to a threshing floor prepared in each farm compound by traditional buffalo cart (lo luan) or by small cart attached to a power tiller. Before the completion in 1973, of the road crossing the Tontan field, the peasants used to haul their sheaves directly from the plot to the threshing floor by traditional sled or luan drawn by a buffalo on the lodged stubble.

In any case, the haulage of huge quantities of sheaves from the large fields is really a major task requiring greater labour than in the narrow valley of Chiangmai village. The peasants have to haul their harvests by boats, sled or carrying pole for as much as 2 km or more from the remotest plots. Both bundling (hop khao) and haulage (kheng khao) are chiefly done by household labour, but some rich households have come to use wage labourers particularly those living within the village. In haulage many households use their own tools and vehicles, but some again depend on hired vehicles.

(8) Threshing and Winnowing

The final stage of Ayutthaya's broadcast-sown culture comes with threshing and winnowing held usually on a threshing floor in the farm

compound. In contrast to Chiangmai, the final operations are all completed after the harvest has been hauled into the dry farm compound. This is mainly because most low-lying plots with their bulk of stubble remaining, which may not be completely dried up, are unlikely to provide a suitable space for these operations. With most of the household labour force continuously involved in a series of tasks after the start of harvesting, the preparation of a threshing floor, or lan nuat has to be completed before or around harvesting time. These techniques in preparation of a threshing floor are fundamentally the same as those practised in Chiangmai village.

The sheaves are loosened and spread around in a large circle on the threshing floor using a straw hook (khan chai). This work is called tok khao. In the traditional method, several buffaloes are tied to a pole usually set in the centre of the floor and threshing is carried out by these animals trampling over the sheaves. In former times, buffaloes were exchanged between households in the same way as labour exchange in harvesting, but this practise is now declining. At present, in place of buffalo threshing, rented power tillers are increasingly used to run over the stalks and thresh out the grain. In 1975 about half of the operating households used a hired power tiller for threshing. While the tiller or buffaloes work over them, the stalks are raised and turned over by using straw hooks,until the threshing is completed. The grain is finally gathered up using a wooden scraper.

After threshing has continued for a few days, a winnowing machine or khrüang si fat, run either by hand or power, is used to separate the chaff and undesirable dust from the grain. Before the introduction of the winnowing machine in the 1950's, a much more simple method of winnowing which is accomplished by the wind and by

shaking a bamboo winnow (kradong) had prevailed as in Chiangmai village.

By contrast to Chiangmai village, soon after winnowing work has finished, most households seek to dispose of their production for sale in January and February, as we have seen already. A number of rice traders or phǫkha rapsü khao come aboard cargo boats to buy the harvest directly from farm compounds along the Khanomčhin canal and transport paddy for sale to rice millers operating along the Nǫi river at Ban Phaen, Sikuk and Čhao Čhet.[53] Most households are likely to sell out the bulk of their product to these traders in this period in order to obtain the necessary cash income to complete various payments. Since land rent is normally to be paid in cash immediately after the completion of production, the tenant and part tenant households have to sell the harvest as soon as possible to complete payment, which accounted for approximately 25 per cent of the gross product in the 1974-75 cropping season.[54]

Throughout the operations of threshing and winnowing regular household workers are always the major labour force, and old people and children are, when necessary, assigned to lighter tasks. Wage labour has, however, become popular, but particularly in the rich households. It is a notable feature, however, that co-operative labour which has declined in most stages of production still exists to some extent in these final operations. Particularly among the upper land tenure groups, there is mobilisation of co-operative labour, though on a quite small scale and between close kinsmen. Co-operation at this stage, in many cases, involves renting of equipment such as power tillers, winnowing machines, and even buffaloes, as well as the labour contribution. This is in marked contrast to Chiangmai's operations, especially in threshing, where manual work takes place on a large

scale under a particular form of wage labour in a somewhat festive atmosphere.

4. Conclusions

In this chapter, we have focused on the description of the complex processes of farming which are currently practised in contrasting ecological contexts. In any description and analysis of types of cultivation, it may be shown that farming operations are essentially a consistent and systematic process, consisting of a series of inter-related operations and techniques. There exists no isolated technique or operation which is conducted arbitarily in the course of any types of cultivation. Moreover, each process of farming is closely linked with various environmental factors, particularly with water conditions, and has socio-economic and cultural implications. In the preceding pages, we have divided the farming process into several basic stages in terms of major operations and growth of plant, for analytic convenience. Each stage of farming operations consists of a set of tasks which must be performed in sequence, as uprooting of seedlings is immediately followed by transplanting, and as ploughing is a prerequisite, with a certain interval, for harrowing. The process of farming is, for peasants, a long one, requiring the successive completion of many stages each composed of a set of sequential tasks before they finally gain their products.

The basic stages of rice cultivation in the two villages under comparison can be summarised as shown in Table 37. The initial stage we call 'selection of seed varieties' involves no actual cultivation operations, but constitutes an individual process of decision-making performed by each operating household during the off-season before

TABLE 37: Basic Stages of Farming Operations in the Two Villages, 1974-75

Stage of plant growth	Stage of farming operations	Main tasks in transplanting cultivation (Chiangmai)	Main tasks in broadcast-sowing cultivation (Ayutthaya)
Vegetative growth period	Selection of seed varieties	Early, medium-term and late varieties.	Late or extremely late varieties.
		Orientation towards subsistence production.	Orientation towards petty commodity production.
	Land preparation	Ploughing, harrowing and levelling by buffalo power.	Ploughing by power devices and/or buffalo power (samruai method); ploughing, harrowing and levelling by power devices or buffalo (phǫloei method).
		Water control	
	Sowing/nursery culture	Preparation of semi-wet nursery.	Direct sowing of ungerminated seeds and cover-ploughing (samruai method); direct sowing of germinated seeds and water control (phǫloei method).
	Uprooting and transplanting	Uprooting and bundling of seedlings.	
		Transplanting, occasionally double transplanting.	
		Water control.	
	After-cultivation	Water control.	Application of herbicide and pesticide.
		Application of manure or fertiliser.	Occasionally hand-weeding.
		Weeding.	

contd/..

TABLE 37 ... contd

Stage of plant growth	Stage of farming operations	Main tasks in transplanting cultivation (Chiangmai)	Main tasks in broadcast-sowing cultivation (Ayutthaya)
Generative growth period	Harvesting	Manual harvesting.	Manual harvesting, occasionally in the water.
	Bundling and hauling	Drying and bundling of stalks in the plot.	Drying and bundling of stalks in the plot.
		Hauling to the threshing floor in the plot.	Hauling to the threshing floor in the compound.
	Threshing and hauling	Preparation of threshing floor.	Preparation of threshing floor.
		Manual threshing.	Threshing by power tiller or buffalo.
		Manual winnowing.	
		Hauling to the granary by ox-cart.	Winnowing by winnowing machine.

Source: 1974-75 Survey.

commencing cultivation. In this initial stage the peasants make a series of major decisions regarding the cultivation, in which selection of seed varieties is most crucial, governing the entire process of operations to be undertaken within the given ecological context. At the same time, the selection reflects to considerable degree the nature of peasants' domestic economy, indicating their production goals.

In selection of seed varieties, though many variables might be taken into account, above all maturation time and adaptability to particular water conditions seem to be of fundamental significance in both cultivation methods. In addition to this, the different maturation times of various varieties allow different times of harvesting and consequently of consumption and selling. There can be seen a marked preference, common among many peasants, particularly poor peasants of the two villages, for those varieties with an earlier maturation time, if ecological conditions allow. In this, however, contrasting economic orientations can be detected between the peasants of the two; the choice of Chiangmai's peasants clearly relates to subsistence, while Ayutthaya's peasants give some consideration to early disposal of their products to the market. Such contrasting aspirations can be observed, explicitly or implicitly, between the two villages throughout the initial decision-making and subsequent stages of operations.

There can be seen considerable differences in tasks between the two methods of cultivation throughout the stages of cultivation, particularly in the first half of the cultivation period up to harvest. There is little doubt that these differences are primarily attributable to the different hydrological conditions pertaining to each locality. The elaborate and repeated work of land preparation, sophisticated nursery culture and conscientious work of transplanting, which are all

essential technical elements in Chiangmai's transplanting culture, are only possible through the well-maintained irrigation system of müang fai. On the other hand, the more extensive techniques of land preparation, direct sowing of seeds on the main plot and the complete lack of the transplanting stage are the central technical characteristics of Ayutthaya's broadcast-sowing cultivation, which is a rational response to extensive cultivation with a total reliance on rainfall and natural deep inundation.

It is worth noting that these radical contrasts in the techniques of cultivation are mainly concentrated at land preparation and in a few subsequent stages which correspond to the vegetative growth period of the plant. During the generative growth period after the plant has finished tillering, in the last months before harvesting and in the subsequent operations to the end of the production cycle, there are few fundamental differences between the two. It is water availability and its associated physical and socio-economic conditions during the early period of cultivation which result in the differentiation of the two methods. However, even in the subsequent stages, there are detailed technical differences, reflecting the ecological and socio-economic conditions of the two villages.

With respect to tools and equipment used in the course of operations the contrasts between Chiangmai and Ayutthaya have become increasingly evident in recent years. Chiangmai's transplanting culture has retained its traditional plough agriculture, with its widespread use of the wooden plough with iron coulter and the harrow drawn by buffalo and a set of simple tools. Most traditional tools have not changed for many decades and are made by the peasants themselves of wood or bamboo, though some of them have parts of metal. Most raw

materials are generally accessible to all the peasants, but the metal elements must be purchased outside the village. With such relative self-sufficiency of tool supply, only two items, i.e., the buffalo as motive power and the ox-cart as a means of haulage,can be regarded as major capital investments for operating households.

On the other hand, Ayutthaya's broadcast-sowing culture which had long been carried out basically under the same conditions as in Chiangmai, already began to use labour-saving machines, such as locally manufactured winnowing machines (khrüang si fat) in the 1950's. Mechanical land preparation and threshing by tractor and power tiller began to appear in the 1960's and application of herbicides and pesticides has become steadily prevalent since the early 1970's. With increasing involvement in mechanical farming and with a wide use of industrial input, Ayutthaya's farming technology has recently undergone a radical change towards more capital intensive agriculture. In contrast to Chiangmai's farming, power devices are only accessible to a few operating households, and hiring devices results in increasing cash expenditure in production. Moreover, it should be noted that the recent widespread use of power devices in land preparation and threshing does not appear to be directed towards bringing about an increase in production at least where broadcast-sowing is concerned, but rather is intended to save labour input from both domestic and outside resources. Likewise, the application of herbicides in substitution for the previous practice of hand weeding is also likely to be labour saving. Ayutthaya's recent change in farming technology thus overall seem to be related to changes in labour utilisation rather than to increase in land productivity.

As we have briefly described in each stage of farming operations, the two methods of cultivation in Chiangmai and Ayutthaya villages exhibit a sharp contrast in the general pattern of labour utilisation. It is obvious, however, that both methods of cultivation basically retain their characteristics of peasant farming in which the regular farm workers of the operating households provide the major part of the labour force, though supplemented by outside resources such as co-operative labour and wage labour. In the preceding discussions we have merely located the nature of labour utilisation in each farming stage. It is now necessary to analyse the patterns of labour utilisation and their socio-economic implications in further elucidation of the distinctive farming systems practised in the two villages.

CHAPTER VIII

FARMING TECHNOLOGY III: LABOUR UTILISATION

The main objective of this chapter is to examine the contrasting patterns of labour utilisation in the production process of rice cultivation, in the technological and socio-economic contexts of the two villages. To this end we attempt to reveal the structural relationships of labour utilisation to the production process which is neatly bound up with the farming technology indigenously established in the two villages. Within such a framework, we shall discuss the functions of co-operative labour and wage labour, the two major non-family labour resources prevailing in rice cultivation, with particular reference to the social relations of production in the contrasting villages. Taking the predominant methods of cultivation in the two villages, we first examine the amount of labour input and its pattern of distribution in relation to the stages of cultivation. This is followed by an examination of the pattern of allocation of labour resources in terms of the farming stages and land tenure status, paying particular attention to the significance of non-family resources. We shall, then, attempt to reveal the social relations of production underlying co-operative labour by distinguishing its two forms: exchange labour and labour service. This is followed by a further investigation into the conditions of wage labour, which is now increasingly significant in both villages, in relation to the traditional co-operative labour. Finally, we shall reach conclusions, emphasising the structural relationship of labour utilisation both to the partiuclar production process and to the socio-economic conditions which have evolved.

1. General Contrasts in Labour Utilisation

In the foregoing two chapters, we have attempted to demonstrate the organisational aspects of irrigation and the complex process of farming operations within the contrasting ecological context in two villages. In these analyses, the peasant farming technology of rice cultivation has also been reviewed with particular emphasis on its relationships to the socio-economic conditions of the villages. Land and tools as the basic means of production have been taken into consideration so far, often in relation to labour resources, which are regarded as one of the basic factors of production. Our discussion in this chapter, then, will be focused upon the problem of how the labour resources are mobilised and allocated in the course of production within the given socio-economic conditions, to which we have already referred in Chapter V.

In dealing with this problem we first make a basic assumption that labour utilisation is an integral part of farming technology, by which a peasant mobilises his own labour and other labour resources available to him to achieve production. We have already identified, by investigating technological aspects of irrigation and farming operations, distinctive characteristics of the production process between the two villages, reflecting its relationships to the ecological system. As suggested, implicitly or explicitly, in the preceding discussions, these different production processes in the complex process of farming operations, and irrigation practices which give a determining technological framework to the farmer, necessarily require their particular pattern of labour utilisation. Within this structural relationship of labour utilisation to the production process of rice cultivation, an individual peasant or his household makes decisions regarding labour input and allocation of

available labour resources to a series of operations and tasks. These decisions made individually might vary from household to household but there seem to be a particular pattern of input and allocation characteristic of the peasant farming in the two villages. It is our main task in this chapter to examine and compare such patterns of labour utilisation, which are considered to be related to the dominant aspirations of the peasant economy, to various customary norms and to socio-economic status within each village.[1]

Generally speaking, labour requirements in rice cultivation are highly variable, according to biological factors such as growth period of the plants and to technological and ecological aspects of cultivation which are represented by the cultivation method. It can also be asserted moreover that a number of socio-economic and cultural variables such as availability of family and non-family labour, land tenure status, and customary arrangements of co-operative labour, have a significant effect upon the requirement of labour input. The total requirement of labour input which is a reflection of these variables, has been calculated and compared by many scholars in order to show differences in areas, cultivation methods, and socio-economic and cultural factors in South East Asia and elsewhere.[2] In calculating the labour input, figures are normally given in units of working man-days or of man-hours per unit area based on various methods of survey such as farmer recall in questionnaire interview, researcher's participant observation and researcher's estimation by comparing existing data. Although there are differences in the basis of calculation and in accuracy, the total requirement of labour input on wet-rice cultivation might be shown as in Table 38 from recent sources in various localities of Thailand.

TABLE 38: Labour Input on Rice Cultivation in Various Areas of Thailand

Village	(Province)	Method of cultivation	Labour input* (man-days/rai)	Source
Intermontane Basin Farming Region				
'Chiangmai'	(Chiangmai)	tr.	27.70	Tanabe, 1974-75 Survey
'Chiangmai'	(Chiangmai)	tr.	21.70**	Tanabe, 1974-75 Survey
Ban Ping	(Chiangrai)	tr.	15.84	Moerman, 1968: 206
Sansai	(Chiangmai)	tr.	22.32	Calavan, 1977: 89
Sansai	(Chiangmai)	tr. (es.)	24.38	Calavan, 1977: 89
Bang Kang	(Chiangmai)	tr.	19.61***	Fuhs, 1979: 89
Ǫn Nüa	(Chiangmai)	tr. (dc.)	40.43***	Fuhs, 1979: 89
Ǫn Tai	(Chiangmai)	tr. (dc.)	48.70***	Fuhs, 1979: 89
Delta Farming Region				
'Ayutthaya	(Ayutthaya)	tr. (es. pd.)	16.58	Tanabe, 1974-75 Survey
Bang Chan	(Bangkok)	tr.	14.50	Kamol, 1955: 106
Sample villages	(Nakhǫn Pathom)	tr.	16.32	Thailand-MA, 1959: Tab. 45
Chao Phraya Delta		tr.	13.75-19.38****	Small, 1972: 102
Ban Chung	(Ayutthaya)	tr.	14.50***	Fuhs, 1979: 54
'Ayutthaya'	(Ayutthaya)	bc. (pd.)	9.36	Tanabe, 1974-75 Survey
Chao Phraya Delta		bc.	8.38-10.88****	Small, 1972: 102
Khayai	(Ayutthaya)	bc. (pd.)	6.35***	Fuhs, 1979: 54
Thap Nam	(Ayutthaya)	bc. (pd.)	3.63***	Fuhs, 1979: 54
North East Region				
Sample villages	(Kalasin)	tr.	10.33*** *****	SOAS, 1978: 43

tr.: Transplanting method bc.: Broadcast-sowing method dc.: Double cropping
es.: Early season cropping pd.: Use of power devices (tractor and power tiller) in land preparation is predominant.
* Labour inputs of various kinds of resource such as family labour, co-operative labour and wage labour in the major operations, under the assumption that a person works eight hours a day.
** Excluding co-operative labour inputs in irrigation
*** Labour inputs other than wage labour, excluding those on operations called 'agricultural support' such as threshing, hauling, irrigation etc.
**** Estimation from various sources by Leslie E. Small.
***** Average labour inputs of five years, 1971-6.

There seems to be a marked difference in labour input per rai between the Intermontane Basin and Delta regions, and between transplanting and broadcast-sowing methods: labour input in the transplanting cultivation of the Intermontane Basin region is quite high, ranging roughly between 16 and 28 man days per rai; this is followed by the transplanting cultivation of the Delta region, with between 14 and 19 man-days per rai; while its broadcast-sowing cultivation is markedly lower at between 4 and 11 man-days per rai. In comparing these figures, there are of course difficulties involved in their bases of calculation. Some figures do not take account of certain operations in the course of calculation, and some exclude inputs by non-family resources. Despite lacking in uniformity and difficulties underlying these figures, we can detect at least a general tendency that the transplanting cultivation of the Intermontane Basin region requires considerably higher labour input than either the transplanting or broadcast-sowing cultivation of the Delta region and that the broadcast-sowing of the latter is achieved with less labour input. The figures for Chiangmai and Ayutthaya villages seem to be consistent with this tendency.

In order to make comparison of labour utilisation between the two villages, we have to, then, take into methodological consideration some points in relation to measuring labour expenditure.

First it should be noted that farming operations and tasks within peasant farming are fundamentally irregular and task-oriented. A peasant must work hard on the farm more than 9 or 10 hours per day from dawn to dusk in certain busy operations such as transplanting, harvesting and threshing, but he may work just a few hours a day in, for example, weeding or the control of irrigation in an individual plot. During the period of relatively low employment after sowing or trans-

planting up to harvesting, he may tend to be away from his field, devoting himself much more to domestic works and wage labour. It can be thus asserted that the work discipline of the rice cultivating peasant is a task-oriented discipline bound up closely with the plant growth and relevant ecological context. The peasant work discipline is, as Edward Thompson points out, fundamentally different from that imposed on the modern industrial worker, which demands greater synchronisation of labour and a greater exactitude in time-routines based on time-measurement as a means of labour exploitation, (Thompson, 1974: 42, 56). Given this irregular and task-oriented nature of peasant farming, the analysis and comparison of labour inputs should be undertaken in terms of the stage of operations, which consists of a series of tasks to be specifically performed as discussed in Chapter VII. In so doing, we can identify the pattern of allocation of labour input to each stage of farming operations.

Second, since wet-rice cultivation often requires in certain stages of operations supplementary labour outside the domestic labour force of the operating family household, much care must be taken to distinguish the types of labour resource mobilised in each stage of operations. The basic non-family resources available in the two villages are co-operative labour, utilised within traditional arrangements and social norms inherent to the village society, and wage labour, increasingly popular in recent years. It is thought that an analysis of the allocation pattern of labour resources in the course of production will reveal major differences in the present production economy between the two villages. We shall return to the analysis emphasising allocation of labour resources, together with a close investigation into the non-family resources in the socio-economic

context, in later sections.

Third, amongst many socio-economic variables relevant to labour utilisation, land tenure status, determining access to the means of production, has a vital effect upon the amount of labour input and its allocation patterns. This is mainly because landholdings, which constitute the most valuable and main assets in any peasant household, seem to generate wealth and power, and consequently have a strong relationship to availability of non-family labour resources. According to Turton's survey in Chiangrai province, those classified as 'rich peasants', owning sufficient landholdings and other means of production rely chiefly on the hiring of wage labour, while 'middle peasants' consisting of smallholders and some part tenants and tenants rely mainly on their domestic labour and on co-operative labour (Turton, 1976: 277). Although such a clear-cut distinction might not be found in the cases of Chiangmai and Ayutthaya villages, land tenure status should be considered as the most significant factor to differentiate the allocation pattern of the labour resources among the operating households as a whole.

Finally, in relation to the first point, the irregularity and task-orientation of peasant labour poses many difficulties in reckoning working time involved in the actual field work. Since the data on working time in the present study were basically obtained by questionnaire interview in relation to the previous cropping year, 1974-75, the figures were given by days worked not by hours worked. Therefore no differences between tasks of working hours in a day worked are taken into account; thus, for example, three hours work in application of herbicides is taken as equal to nine working hours in harvesting. Another point which should be stated is that no allowance is made in relation to labour

efficiency between a regular farm worker and a school-age child or old-age person within a family household, and between these domestic workers, co-operative workers, and wage labourers hired on piece work or daily bases (Kamol, 1955; Demaine, 1974: 2).[3] Despite these difficulties involved in measuring working time, our data appear to be consistent enough to indicate different patterns of labour allocation in the two villages.

Taking these points into consideration, general patterns of labour input in the two villages in terms of stage of farming operations and of land tenure status can be shown in Table 39 and Figures 35 and 36. It is clear that there is a marked difference in total labour input between the cultivation methods predominant in the two villages; Chiangmai's transplanting cultivation requires 21.70 man days per rai, accounting for more than twice the 9.36 man-days per rai in Ayutthaya's broadcast-sowing cultivation and still considerably higher than the total required in Ayutthaya's newly introduced transplanting culture in the early season (16.58 man-days/rai). Since the final figures are calculated only in seven stages of operations undertaken in each operating household, they do not include labour requirement in irrigation task performed co-operatively within mu fai. As we have already seen in Chapter VI, the labour requirement imposed on every operating household in maintenance of a traditional müang fai system amounts to about six days' work for making repairs to the fai and for dredging canals. In addition to this, several days must be devoted to preparation of construction materials. Conversely, Ayutthaya's broadcast-sowing cultivators have basically nothing to do with such co-operative works so far as they rely on rainfall and inundation within the huge irrigation scheme operated by the government. Therefore if labour input in irrigation works were taken

TABLE 39: General Patterns of Labour Input by Stage of Farming Operations and Land Tenure Status in the Two Villages, 1974-75 (man-days/rai)

Land tenure status	No. of house-holds	Area planted* (rai)	Aver. No. of farm workers	Land prepa-ration	Sowing/ nursery culture	Uproot-ing/trans-planting	After-cultiva-tion	Harvest-ing	Bundling/ hauling	Threshing/ hauling	Total
Chiangmai Village (Transplanting Cultivation)											
LO	13	62.75	2.38	3.70	2.42	4.60	2.33	5.39	1.99	3.38	23.81
OO	31	200.50	2.68	3.55	2.95	3.94	2.58	4.98	1.80	2.50	22.30
PT	14	84.25	3.00	3.41	2.54	3.35	2.77	4.53	2.09	2.68	21.37
T	54	332.00	2.63	3.62	2.72	3.69	2.51	4.37	1.59	2.53	21.03
Total	112	679.50	2.66	3.58	2.74	3.80	2.55	4.66	1.75	2.62	21.70
Ayutthaya Village (Broadcast-sowing Cultivation)											
LO	6	163.00	2.50	1.09	0.20	-	0.21	5.37	1.34	1.15	9.36
OO	7	200.75	4.00	1.16	0.46	-	0.23	4.36	2.29	1.39	9.89
PT	13	465.25	3.85	1.17	0.48	-	0.30	4.72	1.88	1.02	9.57
T	17	276.75	2.82	1.15	0.44	-	0.36	4.04	1.75	0.87	8.61
Total	43	1105.75	3.27	1.15	0.43	-	0.29	4.58	1.84	1.07	9.36
Ayutthaya Village (Transplanting Cultivation)											
All cat-egories	15	125.25	3.40	1.37	0.96	2.85	1.80	4.31	3.81	1.48	16.58

LO : Landlord operator OO : Owner operator
PT : Part tenant T : Tenant
* : The figures of area planted given here are different from those of area operated shown in Tables 23 and 24.

Source: 1974-75 Survey.

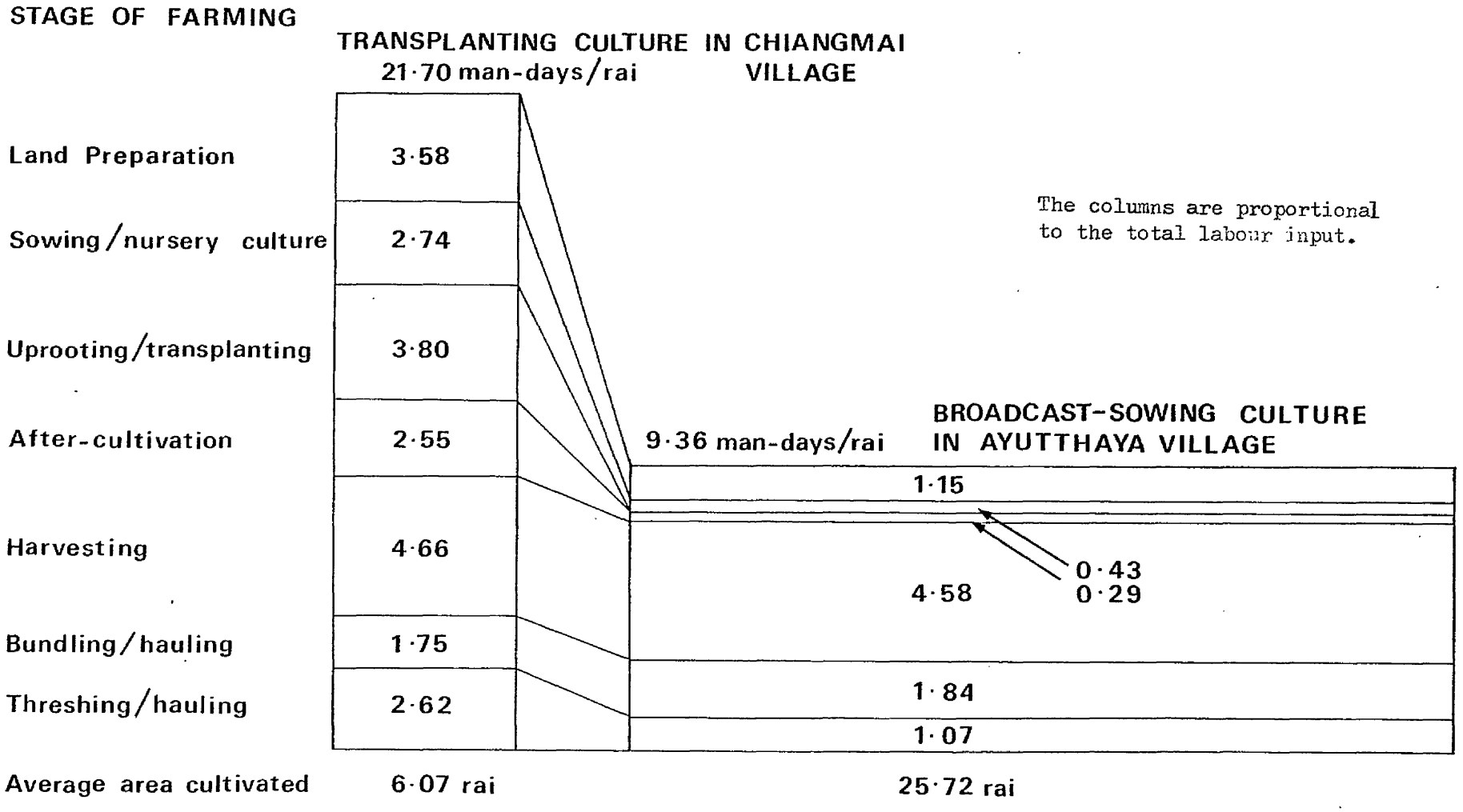


Figure 35: Average Labour Input per Unit Area by Stage of Farming Operations in the Two Villages, 1974-75

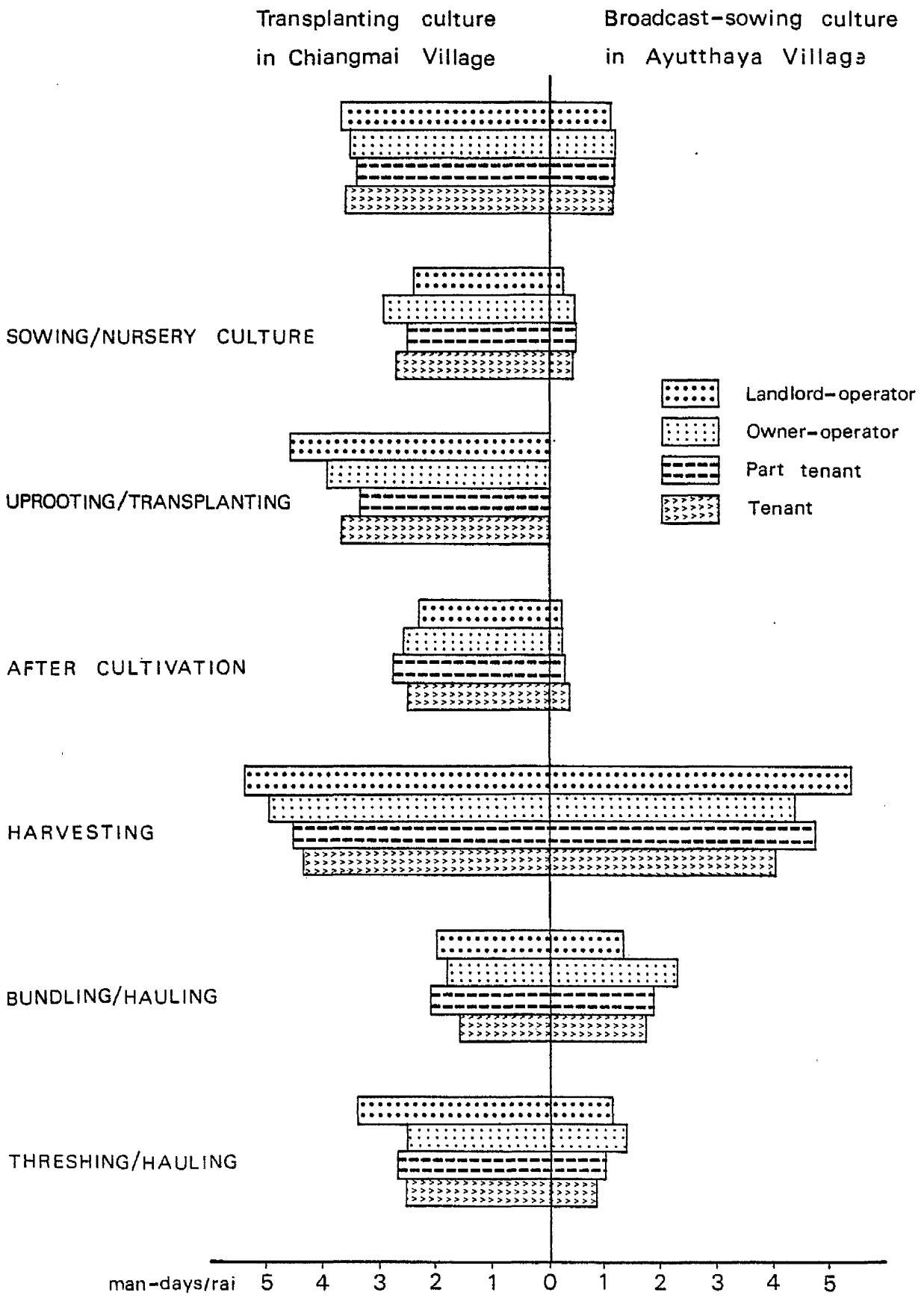


Figure 36: Average Labour Input per Unit Area by Land Tenure Status in the Two Village, 1974-75

into account, Chiangmai's figures would be even higher, amounting to more than 27.70 man-days per rai cultivated.

In addition to the difference in total input per unit area, the allocation of labour input to the stages in the course of cultivation exhibits a profound contrast between Chiangmai's transplanting culture and Ayutthaya's broadcast-sowing culture. Chiangmai's labour inputs are mostly higher at each individual stage of operations and are allocated fairly evenly over each stage with emphasis, of course, on harvesting and the transplanting processes. The intensive and long-lasting operations by buffalo motive power with traditional plough and harrow also leads to a longer working time in land preparation stage. On the other hand, the pattern in Ayutthaya's broadcast-sowing cultivation shows relatively low labour input in most stages, except for harvest on which approximately half of the total labour input is concentrated. In addition to this, the prevalent use of farming machinery such as tractor and power tiller obviously reduces labour inputs in land preparation and, to some extent, in threshing and hauling operations. In particular, the input in land preparation, which has traditionally been less intensive even by buffalo ploughing, given the size of holding, remains on average 1.15 man-days/rai, only a third of that required in Chiangmai. These contrasting patterns of labour allocation in the various stages of operation in the two villages seem to be consistent with our field observation of farming operations described in the previous chapter.

From a comparison of labour input per unit area, it is obvious that Chiangmai's transplanting culture is characterised by high labour intensity, and Ayutthaya's broadcast-sowing culture by comparatively low labour intensity. However, if we draw attention to the total labour input

per operating household, Ayutthaya's extensive cultivation over large areas naturally requires higher labour expenditure than Chiangmai's intensive cultivation restricted to tiny plots. A glance at the average planted area per household (Chiangmai: 6.07 rai; Ayutthaya: 25.72 rai) and the average labour input per unit area (Chiangmai: 21.70 man-days/rai; Ayutthaya: 9.36 man-days/rai) shows that Ayutthaya's total labour input is considerably higher, amounting to 240.74 man-days/household, nearly twice that in Chiangmai (131.72 man-days/household) as shown in Figure 35. This implies that Ayutthaya's farming as petty commodity production has been attained through the mobilisation of an enormous amount of labour, despite its apparently low labour input per unit area. In Chiangmai conversely, high labour intensity per unit area has been a necessary means to achieve a high yield level within the limited area for subsistence production, but the total labour requirement of each household remains only moderate.

There seems to be no basic difference in patterns of allocation of labour in the various stages of cultivation between the land tenure category groups in either village as shown in Table 39 and Figure 36. All categories of peasant household follow a similar pattern of labour use from land preparation up to the final stages, according to the cultivation method. Between the categories, however, differences in labour input per unit area at some stages of cultivation can be detected. In some stages, such as land preparation, sowing and nursery culture, and in the period after planting there is little if any difference. But a noticeable difference can be found particularly in the stages of uprooting and transplanting and of harvesting when peak labour demands occur. In these two stages of Chiangmai's transplanting cultivation the upper strata of peasant households, landlord-operator and owner-operator,

make a higher labour input than the lower categories, the part tenant and tenant. In Ayutthaya's broadcast-sowing cultivation the landlord operator category exhibits a higher input in harvesting than any other categories, followed by the part-tenant category. It should be noted in the connection that most of Ayutthaya's part tenants are principally landed rich peasants who operate considerable areas combining their own holdings with additional rented lands. Thus, there seems to be a general tendency that the rich peasants in both villages, mostly landlord-operator and owner-operator, but including the part tenant in Ayutthaya village, make higher labour inputs on the crucial and most labour intensive farming operations than tenant and part tenant.

A similar tendency can also be detected in the total labour expenditure per unit area between the land tenure categories. As shown in Table 39, the total input per rai in Chiangmai village is higher in the upper categories, declining towards the tenant group and in Ayutthaya village higher inputs are reached by the upper tenurial categories, with the tenant group having the lowest. All these differences in labour input imply the existence of difference in availability of labour resources between the land tenure categories. It may be predicted that the disparity of labour input is most likely derived from the varying availability of non-family resources of co-operative labour and wage labour. We need therefore, to examine, by comparing data in the two villages, the available labour resources and the pattern of their allocation in the production process. In so doing, we shall examine the problems in relation to land tenure status, and hopefully reveal the overall structure of labour utilisation in the two villages.

2. Allocation Patterns of Labour Resources

In the preceding discussion, we have attempted to demonstrate the contrasts between the two villages in total labour input and in pattern of allocation between the stages of farming operations. We move, now, to examine the question of what types of labour resource are mobilised, and how they are allocated to the stages of operations in the production process. As we have indicated earlier, it can be assumed that labour utilisation as a peasant farming technology has a structural relationship to the particular production process of rice cultivation. In addition to the total requirement of labour input and its allocation to the stages of operations, available labour resources and their allocation seem also to be bound up with the particular production process.

There is a set of labour resources in rice cultivation common to the two villages and to most localities of the countryside under the current socio-economic situation : these are family labour of the operating household itself, and co-operative labour and wage labour as non-family resources. As we have already seen in Chapter V, the family labour force as the basic resource in both villages consists of several members (mostly 2 to 4) of regular farm workers and marginal labour units such as school-age children and aged dependents who may be mobilised at various stages for lighter casual tasks. Aside from these marginal units which constitute irregular and supplementary resources, the number of regular farm workers normally indicates the size of labour force in a family household. As we have discussed in Chapter V, the average number of regular farm workers per household in Ayutthaya village is larger than that in Chiangmai village (Tables 17 and 18). The average number amounts to approximately 4, particularly

among Ayutthaya's owner-operators and part tenants, who are the main group engaged in commodity production, operating more than 30 rai. In contrast to the small-scale subsistence production in Chiangmai village, there seems to be a problem of labour shortage involved in operating broader plots, particularly those of over 30 rai, in Ayutthaya's commodity production.

Rice cultivation frequently requires supplimentary labour resources in addition to family labour, regardless of whether the plot being operated is large or small, or of whether it is oriented towards subsistence or petty commodity production. As we have stressed elsewhere, there are particular stages of cultivation such as uprooting and transplanting and harvesting, in which supplementary labour resources must be mobilised in any operating household. This seems to be necessitated by the ecology of rice cultivation itself rather than other socio-economic factors. The operations of uprooting and transplanting must be completed within a limited time in order to prevent young seedlings from drying out. The harvesting operations must be performed within a short period after the ripening time to avoid the losses caused by lodging of stalks and shattering of grains. To complete these crucial operations efficiently requires certain speed at the optimum ecologically fixed time. Such ecological and technological requirement entails the peasants in a dependence on outside labour resources in addition to their own limited supplies.

It can be assumed that this very nature of rice cultivation has resulted in the necessity for co-operation in the production process among the peasant households. Co-operative labour has been an essential complement to household labour in the production process, requiring specific social relationships and organisational arrangements.[4] Wage

labour, the other external resource, is principally a substitute for co-operative labour, which has generally occurred under the recent penetration of money economy and the development of capitalistic relations of production in the countryside. However, we have to bear in mind at least two points in this connection: first the substitution has recently occurred not only for the traditional co-operative labour but also for family labour itself, particularly for marginal labour units within the family household in both villages; second, wage labour, despite its rapid expansion in recent years (particularly since the 1960's), has long existed as a form paid in kind in both villages.

With these points in mind, we can now examine the question of how the three types of labour resources are allocated in the various stages of cultivation in the two villages. Figure 37 shows the percentage of the total labour input at each stage of operations coming from the different labour resources, comparing Chiangmai's transplanting and Ayutthaya's broadcast-sowing cultivation. The proportion of family labour in the total input in both the villages is incidentally of the same order, as much as 56 percent, with the rest supplied by non-family resources (see Table 40). In Chiangmai's transplanting cultivation, the dependency on non-family resources is greatest at the stages of transplanting and harvesting and, to some extent, in the stages of bundling and threshing. Amongst the non-family resources, the utilisation of co-operative labour is considerably higher than that in Ayutthaya village; it particularly concentrates on the two labour intensive stages, and to some degree on the preparation of nursery beds and bundling. In the stage of threshing and winnowing, as we have already noted, the use of co-operative labour is minimal, due to the peculiar mobilisation of younger people who are regarded as wage labour. Despite

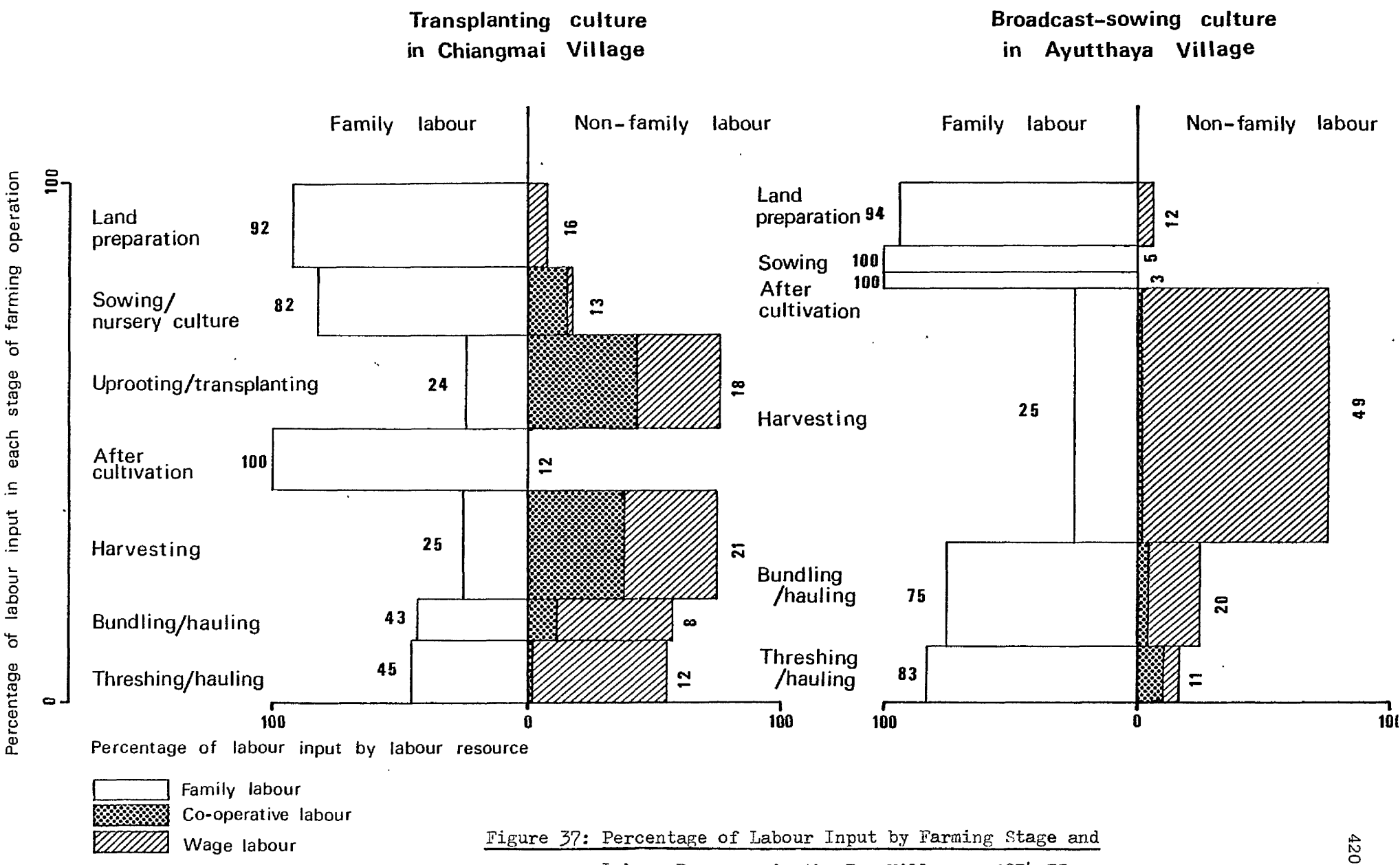


Figure 37: Percentage of Labour Input by Farming Stage and Labour Resource in the Two Villages, 1974-75

TABLE 40: Allocation of Labour Resources by Land Tenure Status in the Two Villages, 1974-75

Land tenure status	No. of house-holds	Family labour man-days/rai (%)	Co-operative labour man-days/rai (%)	Wage labour man-days/rai (%)	Total man-days
Chiangmai Village (Transplanting Cultivation)					
LO	13	11.46 (48)	5.42 (23)	6.93 (29)	23.81
OO	31	12.13 (54)	4.15 (19)	6.02 (27)	22.30
PT	14	12.11 (56)	3.11 (15)	6.15 (29)	21.37
T	54	12.23 (58)	4.07 (19)	4.73 (23)	21.03
Total	112	12.11 (56)	4.10 (19)	5.49 (25)	21.70
Ayutthaya Village (Broadcast-sowing Cultivation)					
LO	6	4.42 (47)	0.13 (2)	4.81 (51)	9.36
OO	7	5.32 (54)	0.32 (3)	4.25 (43)	9.89
PT	13	5.29 (55)	0.19 (2)	4.09 (43)	9.57
T	17	5.54 (64)	0.15 (2)	2.92 (34)	8.61
Total	43	5.23 (56)	0.20 (2)	3.93 (42)	9.36
Ayutthaya Village (Transplanting Cultivation)					
All categories	15	11.12 (67)	0.62 (4)	4.84 (29)	16.58

LO : Landlord-operator OO : Owner-operator
PT : Part tenant T : Tenant

Source: 1974-75 Survey

the strong orientation towards subsistence production, wage labour has recently become prevalent in many stages, especially the two most labour-intensive stages and at bundling and threshing. However, the proportion of wage labour in the total labour input remains only 25 per cent, which is far lower than the 42 per cent in Ayutthaya's broadcast-sowing culture (Table 40).

Ayutthaya's pattern is quite different from that in Chiangmai village. The use of non-family labour resources is concentrated overwhelmingly on the harvest stage and is rather limited in other stages. It is notable that Ayutthaya's broadcast-sowing culture concentrates nearly half of its labour input in harvesting, in which the greater part is supplied by wage labour. This heavy input of wage labour on harvesting did not begin only in recent years, but seems to go back to earlier periods, even as far as the pioneering days at the turn of the century. Since then, most operating households have increasingly depended upon migrant labourers, first from the North East region, and more recently on those from the northern provinces in and out of the Delta farming region. Under such wide prevalence of wage labour, the use of co-operative labour has been relatively underdeveloped from the beginning and currently remains only among a few households mainly for threshing. It accounts for only 2 per cent of the total labour input.

These differences in allocation of labour resources, thus, indicate a general contrast in labour utilisation between the two cultivation methods. Chiangmai's transplanting cultivation is undertaken with a relatively even allocation of labour to all the stages of operations. Mobilisation of non-family resources is particularly important in the two labour intensive stages, transplanting and harvesting,

in which co-operative labour has a significant role. By contrast, in Ayutthaya's broadcast-sowing cultivation, a strong emphasis is laid upon harvesting which is chiefly carried out by wage labour. The utilisation of wage labour as the main non-family resource has been increasingly indispensable in the production process.

Recognising the clear contrast between the two villages, then, we return to the question of the possible disparity of labour input and of availability of the non-family resources between the land tenure categories. Table 40 shows the utilisation of the three labour resources according to land tenure status in the two villages. With respect to the input of family labour, there is a common tendency in the two villages: the ratio of family labour in the total input is the highest for the tenant group and is rather low for the landlord operator with less than 50 per cent; conversely, the landlord group is most dependent on non-family resources and the tenant group shows a considerably lower dependency. The owner-operators and part tenants form an intermediate category.

Among the non-family resources, in Chiangmai's transplanting cultivation, the use of co-operative labour is extensive among the landlord-operators, showing a decline towards the lower categories, particularly in the part tenant. Likewise, the utilisation of wage labour is highest in the landlord-operator group and least among the tenants. In Ayutthaya's broadcast-sowing cultivation the input of co-operative labour is minimal regardless of land tenure category. On the other hand, the input of wage labour is extremely significant in every category and shows a similar tendency as in Chiangmai's case in disparity between the land tenure categories; the landlord-operator group makes the greatest use of wage labour, while the tenant group

exhibits a relatively lower level of use.

From the above discussion, we can detect a general tendency in labour utilisation common to the two villages. There seems to be a tendency towards a clear disparity in availability of non-family labour resources between the rich peasants and the poor peasants. The upper strata are able to mobilise more non-family resources, while the lower strata tends to rely upon their own family labour. It is also conspicuous that there is a marked contrast in the combination of non-family resources between the two villages. Chiangmai's transplanting culture has retained an extensive use of co-operative labour at many stages of cultivation and this has a significant role among most operating households in every land tenure category. By contrast, Ayutthaya's broadcast-sowing culture, in which wage labour was already prevalent during the pioneering days, has almost completely substituted wage labour for traditional co-operative labour in most households throughout the farming process. Whatever their origin, however, it should be stressed that non-family labour resources occupy a crucial place in the labour utilisation pattern of many operating households. In this connection, it is necessary to investigate more carefully the function of non-family labour resources and their socio-economic implications in the context of peasant life in the two villages.

3. Co-operative Labour

In the foregoing chapters we have sometimes touched upon co-operative labour and, more specifically, labour exchange, as a general term for sources of labour external to the family other than those obtained by wage payment. It is necessary, however, here to add more clarity to

the definition of co-operative labour, in the light of a theoretical framework, when we discuss the specific forms of co-operative labour relevant to the contemporary socio-economic conditions of the two villages.

The most general and comprehensive definition of co-operative labour is probably given by Marx, who suggests that "when numerous labourers work together side by side, whether in one and the same process or in different but connected processes, they are said to co-operate, or to work in co-operation" (Marx, 1954: Vol.1, 308). The effect which can be brought about by means of co-operation is, as he says, not only to increase the productive power of the individual, but to create a new power, i.e. the collective power of masses. Co-operative labour, taking place, in most cases, at the same time or on the same kind of work, and stimulating the efficiency of each individual worker, can shorten the time necessary for the completion of the tasks (ibid.: 309-210). Recognising the general characteristics of co-operative labour, Marx argues for the need to distinguish the form of co-operation which has been practised historically in peasant agriculture[5] from capitalistic co-operation that is essentially attained only by the free wage-labourer who sells his labour-power to capital (ibid.: 316-317). The former with which we are directly concerned, should, therefore, be examined in the context of peasant agriculture practised within a specific social context structurally different from fully developed capitalism. In other words, the form of co-operative labour in peasant farming should first be sought in terms of a set of productive forces and social relations of production in a specific social context.

The above theoretical framework which Marx initially set out, indicates a twofold analytic line at the empirical level for examination of the socio-economic nature of co-operative labour in peasant agriculture: first, co-operative labour must be analysed in relation to productive forces, which are basically determined by a particular ecological and technological context; second, the functions of co-operative labour can be investigated within the context of socio-economic relations of production.[6] For the technological context, Marx points out the existence of critical periods, such as harvesting, "determined by the nature of the process, during which certain definite results must be obtained" (ibid.: 310). For these critical periods, the combined working-days attained by means of co-operation, produce, compared to an equal sum of isolated worker's working-days, "a greater quantity of use-values, and consequently diminishes the labour time necessary for the production" (ibid.: 311). Such technological interpretation of the requirement of co-operative labour and of its effect upon the production process seems to provide a possible framework for the empirical analysis of co-operative labour concerned with peasant farming in the two villages.

The other aspect of analysis is directed towards clarification of the relations of production involved in labour co-operation among the peasants. Although the notion of relations of production is a highly abstract concept in its original sense of being structured within the concept of modes of production,[7] it is still applicable to empirical examination of the concrete forms of socio-economic relations established between the various categories of peasants within the village context. Analysis in terms of socio-economic relations seems to be necessary to distinguish different forms of co-operation and to

detect the socio-political implications involved in organising co-operative labour.

Bearing in mind these analytic frameworks dealing with co-operative labour, then, we turn to examine the problems peculiar to the forms of co-operation practised in rural Thailand. A number of scholars who have conducted community studies in various localities since the late 1940's, have pointed out the significance of co-operation in the production process of rice cultivation. They, mainly American anthropologists, describe co-operative labour, focusing mainly upon the reciprocal exchange of labour, which is variously termed, ao raeng (literally, taking one's labour), long khaek (laying down guests) and ao mü (taking one's hand) etc., depending on the area. Many of them find co-operative work groups organised among the operating households at uprooting-transplanting and harvesting and stress is laid upon the tendency that these groups are organised loosely and informally. This is particularly dominant among the anthropologists following the 'loosely structured social system' thesis on the structure of Thai society,[8] which was initially proposed by Embree and reinforced by the group centred around the Cornell Thailand project (Embree, 1950: 181-193; Sharp et al., 1953: 30, 154; Kamol, 1955: 111-114; de Young, 1958: 79; Phillips, 1965: 22; Piker, 1964: 53-54; Kingshill, 1976: 42-44). On the other hand, on the basis of his research in a village of Chiangmai province, Potter has recently tried to show instead that the reciprocal labour exchange group is a relatively formal and permanent social network, which could be placed between Japanese and Chinese corporate groups on the one hand and on the other extreme a friendship group based only on dyadic ties (Potter, 1976: 47, 167-175).[9] It is obvious that this argument again remains within contraversy over

the 'loosely structured social system', which pays little attention to productive forces and to the social relations of production.

Most of these discussions, though emphasising the existence of reciprocal exchange of labour and its relations to other social organisations such as kindred and village community, largely fail to show its technological connection and to detect socio-economic relations underlying such exchange. It should be also noted that in these discussions too much stress is laid upon the reciprocal and egalitarian norm in co-operative labour and this is misleading in failing to distinguish any different forms of co-operation which might be mingled with what the writers regard as labour exchange. With respect to this problem, Kaufman's finding of two different types of co-operative relationship in Bang Khuat, a village north-east of Bangkok, is quite valuable. The first type is the well known ao raeng, a reciprocal exchange of labour mobilised for harvesting, transplanting and pool digging, under the principle that one soliciting help is bound to return the same amount of work to each guest worker at a future date. The second type is called khǫ raeng (asking for one's labour), essentially a form of free labour service in which landlords and other rich households conscript their tenants and debtors for transplanting and harvesting. Although khǫ raeng is basically free service to the patron, he is expected to furnish the assembled workers with some food and ricewine.[10] In contrast to the reciprocal exchange of ae raeng, the latter is essentially the exploitation of the labour power of the poor and its compulsory nature is obvious when Kaufman says that they "are obliged to comply, for the patron can refuse to lend money or rent property to them the following year" (Kaufman, 1960: 30). As Erasmus and Moore have shown in Latin America and elsewhere, such exploitative labour service,

which they term 'festive labour' is widely prevalent in many agrarian societies where socio-economic differentiation between peasant households is relatively advanced (Erasmus, 1956: 445-449; Erasmus, 1961: 148-153; Moore, 1975: 274-276). In any case, the evidence in Bang Khuat is enough to suggest that wider existence of labour service as distinguished from the form of labour exchange as a reciprocal economic transaction found in other parts of contemporary rural Thailand.

Given the general analytic perspective and the problems particular to co-operative labour in the peasant farming of rural Thailand, we shall now return to the specific cases in the two villages under study. As we have already revealed in the previous section, supplementary labour has been a necessary component of labour requirement in peasant rice cultivation, mainly in relation to its ecological and technical requirements. In Chiangmai's transplanting cultivation particularly, the two labour-intensive stages, uprooting-transplanting and harvesting, still depend to a considerable degree on co-operative labour. In Ayutthaya's broadcast-sowing cultivation, although wage labour has played an increasingly significant role since the beginning of this century, forms of co-operative labour were still retained in many operating households at the latest until the late 1950's. Up to then, much co-operative labour had been concentrated on harvesting and was used also, to a lesser extent, in threshing, in which it remains of marginal importance up to the present. Between the two villages, there are, thus, differences in the stage of cultivation on which co-operative labour is concentrated and in degree of its utilisation at present. However a close field observation in Chiangmai village and interviews to reconstruct the old practices now disappearing in Ayutthaya village, enable us to reveal some common characteristics of co-operative labour concerned with social relations of production.

In the two villages, co-operative labour can be placed into two distinctive forms in terms of organisational arrangement and its associated social relations. The first is exchange labour which is principally based on the reciprocal exchange of labour practised widely between the operating households, the second is labour service to the patron by the client, which is characterised by a dependency relationship between the rich peasant and the poor peasant including rural labourer's households.

(1) Exchange Labour

The reciprocal exchange of labour is customarily called ao mü sai mü (taking one's hand and returning one's hand) or simply ao mü in Chiangmai village, and ao raeng (taking one's labour) or long khaek (lying down guests) in Ayutthaya village. Our discussion will here focus mainly upon the evidence in Chiangmai village for the purpose of descriptive and analytic convenience. It is one of the major organisational characteristics of Chiangmai's labour exchange that it has no fixed group of co-operation but is essentially a reciprocal transaction between individual households. The customary exchange principal is that one household asking for hands (mü) from other households is obliged to return to them exactly the same amount of labour power which is measured basically in man-days.[11] Since the exchange of labour power is valid in various stages throughout the production process, the receiving household may return its obligations either in the same kind of work or in others: thus, if A asks for 3 man-days from B and for 2 man-days from C in the stage of uprooting and transplanting, A may be required to return his household's labour to the amount of 3 man-days in, say, the same transplanting work to B and return 2 man-days to C in harvesting. When A is unable to

return the total amount of labour within the same cropping year for any reason, he may be allowed to complete the amount owed to B or C in the following cropping season. The exchange arrangement is thus based on individual transactions of labour performed in various stages of operations over years. This gives the labour exchange a distinctive organisational characteristic that is distinguishable from the form of group exchange as well as from the strictly organised co-operation of an irrigation control group or mu fai which we discussed in Chapter VI.

The nature of the relationship between individual participant households can also affect the possible compensation in case of failure to keep one's promise. If A becomes unable to return to B the debt of 3 man-days for any reason, and B needs it at a particular stage of operation within the cropping year, A may complete the debt mainly after harvest by payment in kind at the rate of one thang of paddy per one man-day labour and occasionally by payment in cash equivalent to the same rate.[12] The compensation thus made has no organisational implications[13] but is restricted only within the relationship between individual households. The other way to compensate the debt is to hire rural labourers or any other person to substitute for A's household workers. This form of substitution of labour power has become popular recently in the village in accordance with the growing population of rural labourers who eagerly seek any bit of casual employment for their survival. These practices of compensation permitted in the labour exchange relationship seem to allow ample scope for wage labour within the arrangement of co-operative labour.

Another principle involved in Chiangmai's reciprocal labour exchange is concerned with the aspect of reward given to guest workers.

In so far as labour power is precisely reciprocated, the host provides no reward for his guests, but he must make provision of food and drink, which has been a socially important element of the exchange custom. An ordinary everyday meal for lunch is normally provided to the guests during the harvesting season in the plot they are working, and in the host's house during the uprooting and transplanting stage, due to the changeable weather and hot temperature outside. After finishing the day's work the guests may also be invited to a more lavish evening meal, which was until ten years ago usually accompanied by such entertainment as a folk dance (ramwong) and music. It is often observed that the family of the host household have to devote themselves to preparing food and the host family has to spend a great deal of money to feed a number of guest workers during the period of labour exchange.[14] It should be noted that to maintain exchange relationship entails every participant household such extra expenses of labour and cash. This feast element has, however, long been socially important to Chiangmai's exchange labour in which leisure and work tend to be still inseparable.

According to Moore's extensive survey on co-operative labour, there can be found two types of labour exchange in general: the first is 'individual exchange labour' in which reciprocal arrangement is made only between individuals; the second type is 'group exchange labour' in which the numbers of an exchange group or team must undertake the same amount of work for each other (Moore, 1975: 272). In the latter, as Moore pointed out, equality of the amount and type of work, and therefore of farm size, may ideally be required among the members of an exchange group, otherwise means of adjustment to equalise the amount of work undertaken by each member would likely be necessary (ibid.: 272, 288).

But the form of labour exchange practised in Chiangmai village corresponds exclusively to the former type of individual exchange labour, which was also widely referred to in Ayutthaya village and in many accounts for other localities. The existence of individual exchange has been emphasised in the case of Bang Chan, a village in the Delta farming region, by Kamol who says that "co-operative work groups were very informally organised. Although the idea was to mobilise labour to work on each members farm in rotation, the work obligation was not collective but was purely bilateral - each farmer receiving help was bound to return the same amount of work to each guest worker individually. There were no such things as group responsibility," (Kamol, 1955: 112). This type of co-operation in the production process seems to be shared by most peasant communities, whether in the Intermontane Basin or in the Delta farming region.[15]

Even though Chiangmai's exchange labour is not organised as a formal and closed group, it might be regarded as a network of exchange as viewed from each individual household. As a general term the exchange network is called mu ao mü sai mü, or literally a group of labour exchange, like the mu fai (irrigation control group), but the former is lacking in the strict regulations and the rigorous social norms which mean sharing a common privilege and responsibility as a group organisation. It is rather a network of relationships established by each household as a means of exchange of labour to cope with labour demand which is highly variable between households. Such a network normally consists of a number of operating households, ranging from two to fifteen.

In establishing the exchange relationships there seem to be three major factors to be considered. The first is kinship ties within a set of bilateral kinsmen or ñat diao kan (being the same kindred) or simply

ñat, which most broadly includes full siblings and descendants in the first and second ascending generations through both husband and wife. It provides to most peasants a social framework outside the family household, in which various forms of social and economic co-operation take place. Within this broad extension of bilateral kindred, relationships between the siblings of both husband and wife in their own generation are particularly significant in exchange labour, but not really in the other form of co-operation, i.e. labour service.

The second factor involved in reciprocal exchange is the proximity of operating plots, which is expressed by na klai kan (plots being close by). The households operating neighbouring plots or those located not so far away within a field, find it much easier to reciprocate their labour, even though they have no kin relations. This is mainly because they are well aware of plant conditions and necessary operations in one another's plots, and consequently can easily make exchange arrangements with each other at the optimal time. The factor of proximity has recently been stressed by the villagers in establishing exchange relationships in Chiangmai village, but not so significantly as is the case of Ayutthaya village and many other localities in the Delta farming region.[16]

The third factor may include neighbourhood of residence and friendship other than kin relation or proximity of plots, and can, in brief, be termed fellowship. The fellowship called pi nǫng kan, or 'older-younger relationship', which is crucially important in the peasant social behaviour as a whole, also functions in bringing people together for labour exchange. The fellowship, in general, does not only denote affinity and intimacy between the older and the younger but also connotes inequality and deference for the older by the younger,

and is stressed between members of a bilateral kindred or ñat diao kan and elsewhere in daily life.[17] Insofar as it is a reciprocal arrangement of exchange labour, which is a purely economic transaction, however, it tends to be more between equals in social status.

These three elements, bilateral kinship ties (ñat diao kan), proximity of plots (na klai kan) and fellowship ties (pi nǫng kan) are fundamental for Chiangmai's peasant households in making reciprocal arrangements for labour exchange to meet the intensive labour input during the critical periods of rice cultivation. Although in reality several factors may combine we can identify through continuous observation and interviews the dominant factor involved in establishing labour exchange in each case. At the same time it is here also necessary to examine the significance of the labour service arrangement which we have identified as of a different nature from other types of labour exchange.

Table 41 and Figure 38 show the amount of labour exchange and the dominant factor in the decision to take part in labour exchange according to land tenure status, based on the survey of 45 sample households in Chiangmai village. It is notable that the reciprocal relationship of exchange labour is on the whole nearly three times as common as the form which infers a dependency relationship. Within the exchange labour type, kinship ties are of greatest significance in the decision making. Proximity of plots and fellowship ties still remain secondary to kinship, accounting for 20 and 11 per cent respectively of the total input of exchange labour. In terms of land tenure status there can be seen a marked difference in mobilisation of exchange labour between the landlord-operator group and other categories. The dependency on exchange labour is quite low for the landlord-operator group, while

TABLE 41: Exchange Labour by Land Tenure Status in Chiangmai Village (45 Sample Households), 1974-75

Land tenure status*	No. of house-holds	Total input of co-opera-tive labour man-days	Exchange labour man-days (%)	Exchange labour by dominant factor man-days (%)		
				Kinship	Proximity of plots	Fellowship
LO	7	178	14 (8)	14 (100)	-	-
OO	8	232	140 (60)	102 (73)	38 (27)	-
PT	7	158	119 (75)	84 (71)	26 (22)	9 (7)
T	23	646	614 (95)	412 (67)	116 (19)	86 (14)
Total	45	1,214	887 (73)	612 (69)	180 (20)	95 (11)

* LO : Landlord-operator
PT : Part tenant
OO : Owner-operator
T : Tenant

Source: 1974-75 Survey

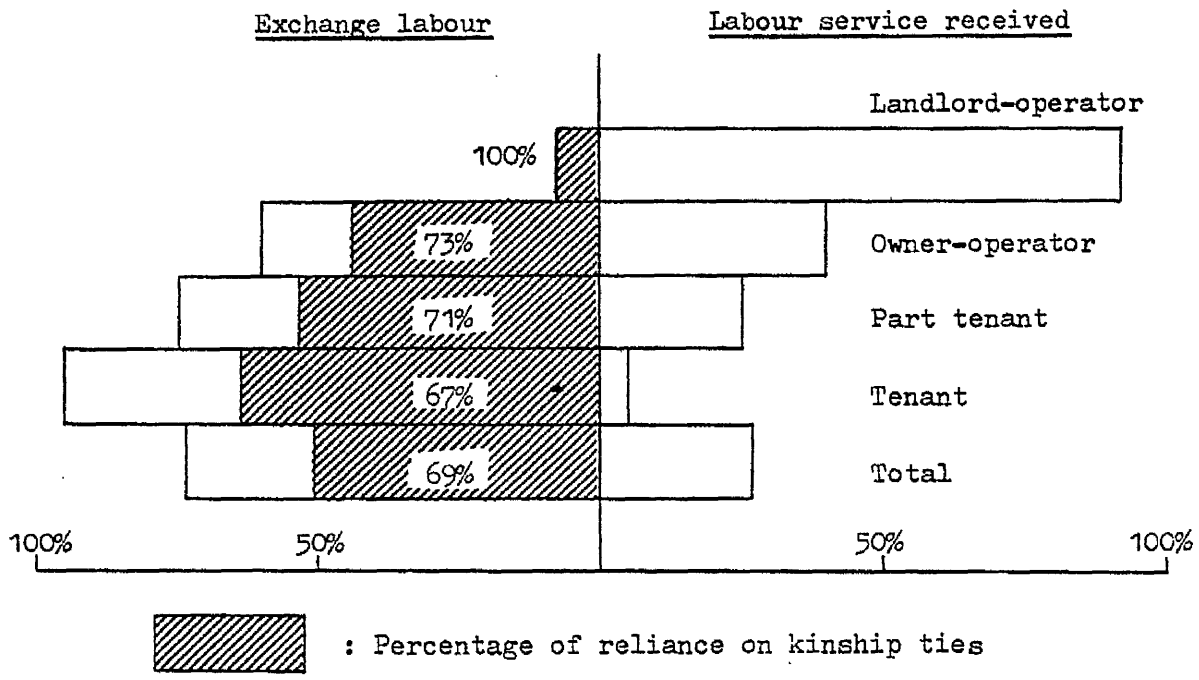


Figure 38: Percentage of Exchange Labour by Land Tenure Status in Chiangmai Village (45 Sample Households), 1974-75

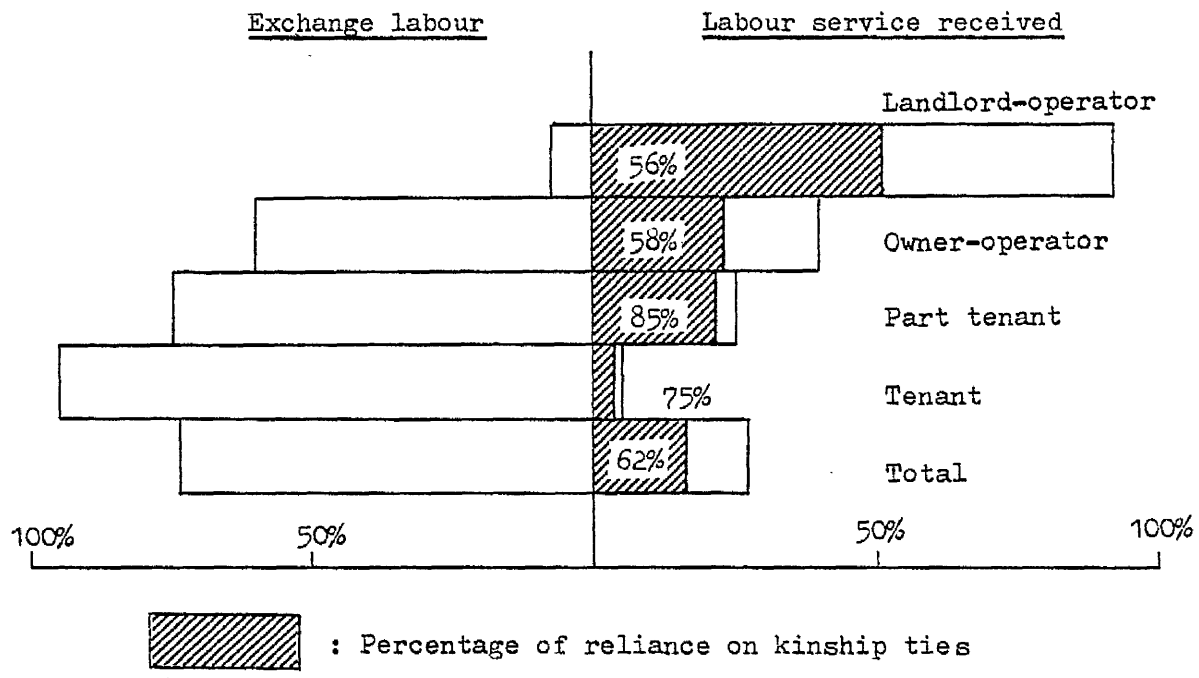
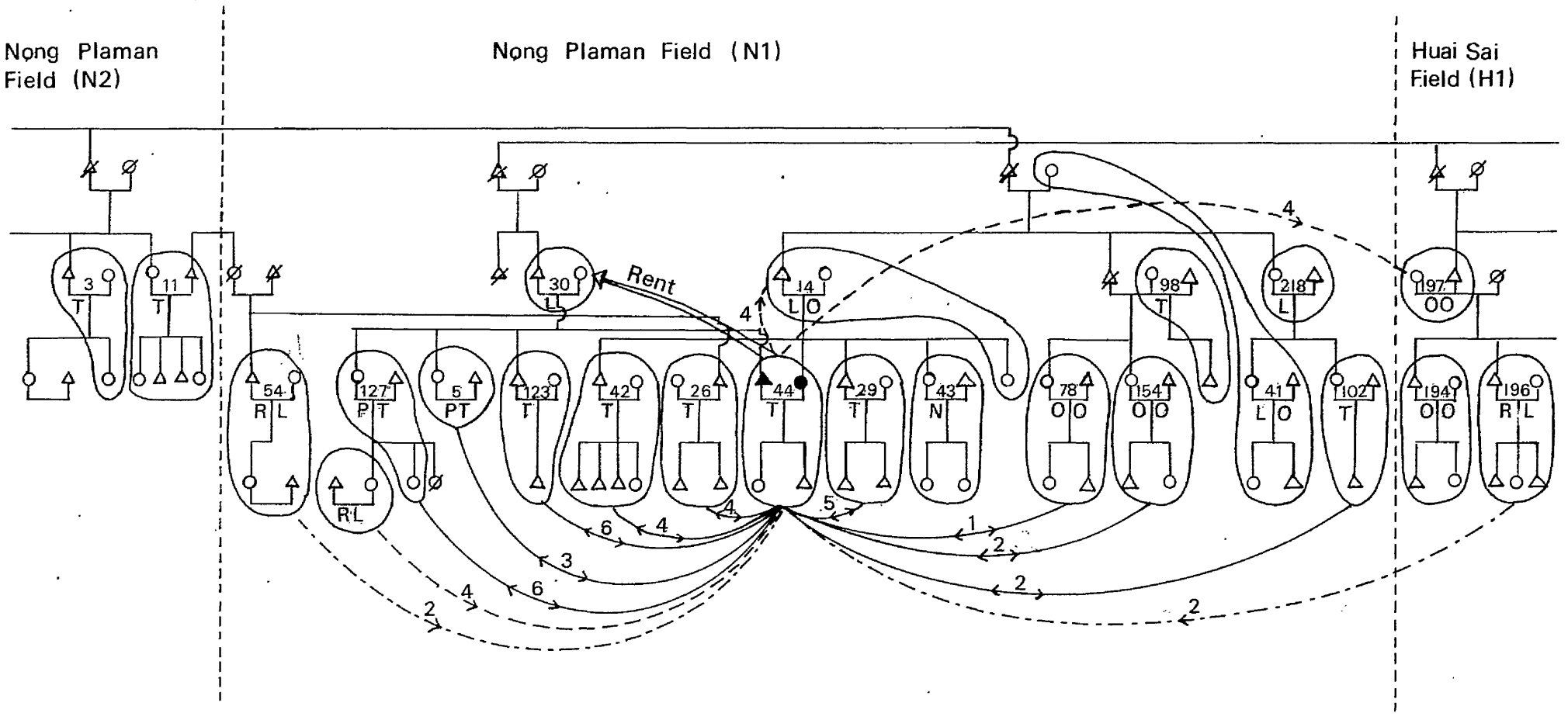


Figure 39: Percentage of Labour Service Received by Land Tenure Status in Chiangmai Village (45 Sample Households), 1974-75

other categories show figures of more than 60 per cent and the tenant category is particularly high with as much as 95 per cent. This indicates that the landlord-operator category is extremely dependent on unpaid labour service while tenants conversely rely heavily on reciprocity arranged through labour exchange networks. It should be noted particularly that utilisation of co-operative labour, which shows apparently no great disparity in the amount of its input between land tenure categories as we have seen in the previous sections, has in fact a clear difference in the nature of the co-operative labour. There is a strong polarity in the mobilisation of co-operative labour between the rich and poor peasants.

Another point to be considered in relation to the nature of reciprocal labour exchange is the tendency for a horizontal alliance to be formed within the same or a near-equal land tenure category and in the same generation. An owner-operator is liable to establish an exchange relationship with other owner-operators and to a lesser extent with part tenants and tenants; a tenant tends to choose his partners from other tenants and to a lesser degree, from part tenants and owner-operators; such vertical contracts as between landlord-operators and tenants or between landlords and part tenants are rarely made.

Figure 40 shows a typical example of an exchange network involving a tenant household (No.44), who operates a plot of 10 rai in the Nǫng Plaman field (N1), which is rented from the husband's father (No.30), a retired local landlord, under the condition of 50 per cent sharecropping.[18] His household, having only two regular workers, has in recent years maintained labour exchange relationships with nine households, all of whom are kinsmen of either the husband or wife in the same generation and who operate plots within the same Nǫng Plaman



L	Landlord	(44)	Household and its number
LO	Landlord–operator	←→	Relation of labour exchange
OO	Owner–operator	- - →-	Relation of labour service
PT	Part tenant	—·→·—	Relation of wage labour
T	Tenant	3	Number indicates amount of labour (man-days)
RL	Rural labourer	●	Male regular worker
N	Non-agricultural household	▲	Female regular worker

Figure 40: Relationships of Labour Exchange and Labour Service involving Household No. 44 of Chiangmai Village, 1974-75

field (N1). These nine partners consist of 3 households of the husband's siblings, 3 of the wife's siblings, and 3 of the wife's first cousins. In the 1974-75 main crop season, No.44 asked from these nine households a total of 33 man-days of exchange labour - 10 man-days in uprooting and transplanting, 17 man-days in harvesting and 6 man-days in bundling - and returned the same amount to them within the same cropping year. Five households out of the nine partner households are tenants as with the example, and part tenants (2) and owner-operators (2) are relatively a minority within the exchange network.

From the above discussions, it can be asserted that the horizontal alliance within near-equal status groups in the same generation is characteristic of labour exchange arrangements. This is, at least in the case of Chiangmai village, because an exchange relationship between households in different land tenure categories is liable to result in violation of the reciprocal contract by the richer household. The categorical distinction between senior and junior[19] which has strong implication of inequality and deference and is often applicable to economic differentiation between the rich and the poor, also functions to exclude vertical relaitonships from labour exchange based on reciprocal principles. So far as Chiangmai's cases are concerned, once a vertical relationship such as between a landlord and a tenant is established, it ceases to be reciprocal but tends to transform into the other form of co-operative relationship characterised by the dependent exploitative labour service.

There is little doubt that Chiangmai's labour exchange with its traditional practices has performed a significant role in labour utilisation throughout the critical periods in the production process up to the present day. With its strictly egalitarian nature in terms

of reciprocity and its horizontal structure in the formation of exchange relationships, exchange labour still remains active among the lower strata of operating households, particularly tenants. However, we have to note some changes indicating an erosion of reciprocal exchange relationships which could lead to the general decline of exchange labour in Chiangmai village. The changes are shown by the recent phenomena of owner-operators tending to increasingly rely on wage labour in substitution for exchange labour, and tenants becoming conversely unable to retain reciprocal exchange relationships. These regressive features of labour exchange can be primarily attributable to the rapid penetration of money economy which has taken place since the 1960's.

In addition to this, further particular reasons can be detected in relation to the organisational characteristics of labour exchange. Above all, the permitted compensation for failure in exchange arrangements can easily lead well-to-do peasants of the owner-operator to the frequent practice of payment in kind and, ultimately, cash-payment for wage labour. This will ultimately result in the break-down of the traditional reciprocity into a wage labour relationship. Secondly, the erosion of reciprocal relationships is also occurring in the lower strata, particularly among poor tenants. For these peasants who are unable to make compensation, their labour tends to become wage labour itself when the richer partners constantly return their debt in the form of cash payment. In addition, the extra expense of labour and cash required to feed their partners in order to maintain social ties has increasingly become a heavy burden on the poor tenants. In contrast to the case of rich owner-operators, the networks of exchange tend to be small and the feasts markedly less lavish among poorer households. Under

such circumstances, the poor tenant households suffer increasing difficulty in maintaining a relationship of reciprocity with other households and tend to eventually withdraw from exchange networks. The erosion of exchange labour is thus steadily progressing, though not yet to a decisive degree, in both the upper and lower strata of the operating households, even in Chiangmai village where subsistence production is still dominant.

In the preceding discussions we have primarily been concerned with the exchange labour system still actively practised in Chiangmai. Exchange labour in Ayutthaya now only existing on a quite small scale, seems to have maintained a similar organisational arrangement and its associated social relations up to the late 1950's but has declined progressively since then. With the more rapid penetration of money economy under the original commercialised production, it has undergone a more drastic erosion of reciprocal relationships in recent years. In the 1974-75 cropping season only 8 out of 43 households who operated broadcast-sown cultivation retained reciprocal labour exchange,and that on a quite small scale.[20] The greater part of the remaining exchange labour is not in harvesting, as was the case during the previous periods, but in threshing. Until the late 1950's, reciprocal exchange relationships, mainly practised in harvesting, prevailed throughout the village, particularly among the middle and lower strata of operating households. The few exchange relationships remaining today are, however, limited to relatively wealthy households and their close kinsmen and often accompany exchange of buffaloes, or ao raeng khwai, and sometimes of farming machinery such as power tillers. It is clear that reciprocal exchange relationships have almost completely disappeared between the very poor peasants who had attached so much value to it.

(2) Labour Service

The second type of co-operative labour we have already mentioned is labour service, called simply čhoi or helping in Chiangmai village and khǫ raeng (asking for one's labour) or simply chuai (helping) in Ayutthaya village. The form of co-operative labour called by such terms is basically a labour service by a client to his patron without reciprocal exchange of labour power.[21] So far as Chiangmai is concerned, the principles underlying labour service are that a senior or richer household, who may be mainly of the landlord-operator or owner-operator groups, asks for unpaid labour service in various stages of farming operations from junior or poorer households who maintain dependent relationships with the former, but that the former never returns the equivalent amount of labour power, but normally provides only food and drink as the immediately tangible reward for the latter. Although the patron as the recipient of labour service may be, in turn, generous to his subordinate client in continuing a tenancy agreement or in repayment of a debt, there is no longer reciprocity, but essentially the exploitation of labour power through the domination of the senior and the rich peasants. Such compulsory relationships between the rich and the poor are, however, basically informal and are established individually as in the reciprocal exchange labour system. It can be safely asserted that the relationship does not represent a direct legacy of the old extra-economic coersion practised during the old feudal régime in the Chiangmai region before the turn of this century,[22] but is essentially a different one resulting from the erosion of reciprocal labour exchange relationships under the progressing socio-economic differentiation among peasant households.

This labour service with such characteristics, distinguishable

from reciprocal labour exchange, has tended to be ignored, with only a few exceptions, notably, Kaufman, and Lucian Hanks and Edward van Roy who put forward the notion of 'entourage'.[23] Andrew Turton's discussion should also be noted in this connection, indicating a compulsory relationship established increasingly between the rich and the poor in his villages studied in the Intermontane Basin region.[24]

One of the reasons for ignorance among a number of scholars of the practice of labour service[25] might stem from the difficulty of distinguishing the different forms of co-operative labour on the spot of actual operations in transplanting or harvesting. In an actual case where co-operative labour is taking place, the guest workers offering their labour on a reciprocal basis and those who are conscripted for unpaid service, together with those who are to be paid as wage labourers, are intermingled in a mass carrying out the same work, and most of them, particularly the former two, may be furnished with food and drink in the context of a lively feast after work. Such an assembly with its subsequent festive atmosphere might lead to a gross misassumption that all those present held a reciprocal position to the host household, even if we do not count those who are obviously hired as wage labourers. Another reason for confusing labour service with reciprocal exchange labour is of more significance, stemming from semantic implications of the term čhoi or helping in Lannathai, as well as chuai in Siamese. So far as čhoi or čhoi kan (helping each other) is performed between the peasants of the same generation and of equal socio-economic status, it is likely to indicate reciprocal relationship. It should be especially noted, however, that between peasants of unequal status in land tenure category or in senior-junior difference, čhoi or čhoi kan implies much more a deferential relationship to the social and economic superior

rather than intimacy and reciprocity.[26] The semantic connotation in this form seems to confuse many geographers and anthropologists, even those who have seriously conducted close participant observation.

Despite such difficulties involved in research of co-operative labour, some scholars recognise different forms of co-operation. Aside from the works by Kaufman, Hanks, van Roy, and Turton, in his study of Ban Ping, Chiangrai province, Moerman distinguishes three major types of co-operative labour in terms of reward to be given for work: fellowship, exchange, and goods (Moerman, 1968: 116). What we are here concerned with is 'fellowship', which denotes, according to Moerman, a type of co-operative labour "for rewards that are neither reciprocated farm labour nor payments in valuables". In 'fellowship', says he, those who give help (čhoi) do not explicitly expect a specific return, but "they come in order to maintain a close relationship with the recipient of their labour" (ibid.: 116-17). We may certainly infer that what Moerman recognised under the word, 'fellowship' in Ban Ping during the early 1960's is obviously a form of labour service or čhoi, which may have been performed between the peasants of varied socio-economic status. His emphasis, probably over-emphasis, laid upon absence of distinct social classes and of economic stratification among the peasants in Ban Ping (ibid.: 104-105, 113) leads to his claim that "completely unknown in Ban Ping is the exploitative 'khǫ raeng' system" (ibid.: 137). However, this assertion seems to be open to question, when we take into careful consideration the connotation of čhoi or čhoi kan, and when we encounter evidence from Ban Ping indicating the existence of large scale landowners with tractors, who accumulated their holdings at the expense of smallholders. (ibid.: 108-109). Our task is to detect social relations underlying the peasant behaviour

called čhoi or čhoi kan, in other words, to detect relations which tend to be masked by the egalitarian terms, between the patron and his clients who, ostensibly, "merely come to help, to čhoi" (ibid.: 116).

The relationship of labour service as practised in Chiangmai village has no formal organisation, rather being built up in relation to the same factors as seen in the case of exchange labour: bilateral kinship ties, proximity of plots, and fellowship ties. In labour service, however, the stress is laid on rather different factors, notably kinship and fellowship. In contrast to exchange labour, when the relationships of exploitative labour service are established between bilateral kinsmen, it tends to be between the younger and older generations. In many cases, poor households of the younger generation enter a dependent relationship by providing unpaid labour to one or several particular wealthy kinsmen's households who may be in the first or second ascending generation. Likewise, in fellowship relationships formed outside the ties of bilateral kinship, deference to the wealthy and the older by the poor and the younger constitutes the labour service relationship. With respect to land tenure status, this subordinate nature of fellowship can be best seen between the landlord and the tenant. Differing from the horizontal and reciprocal linkage emphasised in exchange labour, vertical relationships are always predominant in cases of labour service.

In relation to this deferent and subordinate nature of labour service, there is a particular form of address for those who are rich male peasants and who are mostly recipients of unpaid labour service from clients of a lower status; they are customarily called pǫ liang, often translated into English, 'father protector' (van Roy, 1971: 120) or 'foster father' (Wijeyewardene, 1971: 231-32). Putting aside the

complicated connotation of pǫ liang,[27] so far as the context of Chiangmai village is concerned, it does not necessarily mean solely a recipient of labour service, but is more widely used as an address for paying respects to a rich and economically successful man. Those peasants called pǫ liang in the village are not numerous, mainly a few landlords, landlord-operators or some well-to-do owner-operators. They are rich and, sometimes, politically powerful in the village context, enough for the poor and the younger to enter their domination. It can be said that the relationship of labour service is built up basically of such social relations which have been formed in a wider context in line with the progress of socio-economic stratification. It should be noted, however, that although most pǫ liang received labour service from their clients, the recipients are not necessarily pǫ liang but include the rich or the older who are not addressed as pǫ liang, and occasionally even have tenant status.

Figure 40 also demonstrates the relationship of labour service viewed from a tenant household. In addition to the nine partner households in reciprocal labour exchange, household No.44 provides unpaid labour service to two households in the first ascending generation: in the 1974-75 cropping season, the husband and wife worked 4 man-days in transplanting and harvesting for the wife's parents' household (No.14: landlord-operator), and worked 4 man-days in harvesting for the husband's great-uncle's household (No.197: owner-operator). The former is the most popular case in which unpaid labour is offered to a close kinsman. In the latter case, the relationship had been established in the previous few years rather in recognition of subordination to a wealthy man who is widely addressed as pǫ liang. This pǫ liang successfully operates a small-scale local rice mill, a

lucrative supplementary business recently started,and cultivates 6 rai of his own main season plot for the family's consumption. The labour service in harvesting became established when household No.44 borrowed a fairly large amount of money from the po liang a few years ago, a debt which has subsequently continued. In other households, the relationship of landlord-tenant is also liable to impose labour service on them.

In addition to these dependent relations, household No.44 has to pay a substantial amount of rent, accounting for nearly 50 per cent of the product, to the husband's father, a local landlord.[28] On the other hand, the household has conversely received unpaid labour service from a rural labourer's household (No.124), that of the husband's nephew. It is said that household No.44 has provided in return a small amount of economic aid and has allowed his nephew to cultivate tobacco in a corner of the rented plot during the off season. This implies that even for some tenant households a relationship of labour service has today begun to be established with households of even lower status and of younger generations.

Table 42 and Figure 39 show the amount and percentage of labour service received and the dominant factors in the establishment of the relationship of labour service according to land tenure status. It is conspicuous that in contrast to reciprocal exchange labour, labour service is much more received by the upper categories of land tenure status, notably by landlord-operators who rely on it to the extent of more than 90 per cent of the total co-operative labour input. This indicates that the utilisation of co-operative labour by landlord-operators, which is apparently not so different in amount from inputs from other lower categories, in fact, is substantially exploitative in

TABLE 42: Labour Service Received by Land Tenure Status in Chiangmai Village (45 Sample Households), 1974-75

Land tenure status*	No. of house-holds	Total input of co-opera-tive labour man-days	Labour service received man-days (%)	Labour service by dominant factor man-days (%)		
				Kinship	Proximity of plots	Fellowship
LO	7	178	164 (92)	92 (56)	62 (38)	10 (6)
OO	8	232	92 (40)	53 (58)	39 (42)	-
PT	7	158	39 (25)	33 (85)	1 (2)	5 (13)
T	23	646	32 (5)	24 (75)	6 (19)	2 (6)
Total	45	1,214	327 (27)	202 (62)	108 (33)	17 (5)

* LO : Landlord-operator
PT : Part tenant
OO : Owner-operator
T : Tenant

Source: 1974-75 Survey

nature. The proportion of labour service received in the total amount of co-operative labour input declines considerably in the lower tenurial status categories, particularly among tenants. Among such groups the reciprocity of co-operation is still overwhelmingly dominant rather than the dependency relationship. With respect to the dominant factor in entering a dependent relationship of labour service, kinship ties are generally of significance as in the case of exchange labour. However, it is worth noting that reliance on kinship ties in labour service is generally less, particularly among the rich landed categories, the landlord-operator and owner-operator, where it is less than 60 per cent, compared with the reliance on kinship ties in exchange labour. It may be implied that these categories are currently expanding relationships, irrespective of kinship ties, for exploiting the labour power of the poor and younger villagers.

The amount of labour service received in Chiangmai village is far less than that of exchange labour, accounting only for 27 per cent of the total amount of co-operative labour. It is quite difficult to trace the changes in amount of labour service in the past. Judging from some interviews with older generations, there seems to have been little change as a whole during the past few decades. It is said, however, that labour service to some powerful landlords or landlord-operators flourished until around the 1940's. In particular, Khun Saisarakit who held power as pǫ khwaen (head of the tambon in that period) from the 1920's through to the early 1940's, was able to conscript, though not in any formally institutionalised way, numerous peasants for the transplanting and harvesting of his plots. It was not unusual, according to the villagers, that more than 80, occasionally 100, peasants, irrespective of whether kinsmen or not, would come to undertake service for the pǫ

khwaen and join the feasts after work. Although the number of peasants mobilised was quite large, they seem to have had a dependent relationship of labour service on an individual basis with the pǫ khwaen, as widely recognised in recent years. As we have pointed out earlier, even in the period of Khun Saisarakit, the form of labour service was already quite different from that of corvée as an extra-economic form of coercion formally institutionalised in the preceding feudal period.

Labour service in the current village context is unlikely to increase rapidly in magnitude and in significance in labour utilisation in the future. Under the current economic situation characterised by the increasing penetration of the money economy, erosion of reciprocal labour exchange relationships is more likely to result in the wider prevalence of wage labour. It will, however, remain to some extent, in so far as dependent relationships are maintained between the rich or the senior and the poor or the junior. Even in Ayutthaya village where peasant rice production was commercialised from the start and wage labour is overwhelmingly dominant, labour service called khǫ raeng is still practised between some households, though on a quite small scale. This implies that this particular form of exploitation of labour power can survive firmly among Thai peasants, despite the strong penetration of the money economy and a growing tendency towards capitalistic social relations in the countryside.

4. Wage Labour

Wage labour as a non-family labour resource has become increasingly significant in the production process of rice cultivation in both villages under study and generally throughout Thailand. Wage labour denotes performance of farming operations through employment in which

the hired person sells his labour power to the operating household as an employer. We are, therefore, basically concerned with the socio-economic phenomenon of wage labour within peasant agriculture, and not with that in a fully developed capitalist production, which involves the complete separation of the direct producers from the ownership of the means of production. In both villages, generally speaking, the demand side, i.e. operating households, is constituted mainly of direct producers holding, though in varying degress, the means of production and requiring wage labour as a supplementary resource only at particular stages of operations as we have described earlier. On the other hand, the supply side includes not only the rural labourer's households, but also a number of peasants who retain their own basic means of production from the lower land tenure categories in and out of the villages. These conditions seem to provide particularity to wage labour in peasant farming, distinguishing it from wage labour in general practised in a developed capitalist production (Lenin, 1960: 177-178, 237-240; Bernstein, 1976: 61).

In the village context, there seem to be considerable differences in the incidence of wage labour, and in its relation to co-operative labour as between Chiangmai and Ayutthaya villages. As we have already seen in the previous section, on the one hand, Ayutthaya's broadcast-sowing cultivation with its long lasting orientation towards petty commodity production, shows heavy dependence on wage labour, while on the other, utilisation of wage labour still remains moderate in Chiangmai's transplanting cultivation with its strong subsistence orientation. Assuming the mobilisation of wage labour first occurs in most operating households as a substitute for co-operative labour as the more traditional form of non-family labour, it is necessary to examine

the relation between the two in the historical and contemporary context.

In Chiangmai village, as perhaps in most parts of the Intermontane Basin farming region, the substitution of wage labour for co-operative labour has taken place slowly throughout history. However, the considerable economic change commencing in the 1960's has brought about rapid increase in the use of wage labour. In contrast to Ayutthaya village, wage labour has always been complementary to co-operative labour, and, to some extent, it is difficult to distinguish from co-operative labour in many cases. In the modern meaning of the Lannathai language, hap čhang (being hired) can correspond to wage labour, and khon hap čhang as the person hired may be used for rural labourer as a distinct category or class distinguished from operating households[29] as seen in Chapter V. Aside from these terms, peasant wage labouring is more commonly expressed as čhoi ao khao (helping to take paddy) or khǫ khao (asking for paddy).[30] Both currently mean wage labour for farming operations, in which the person hired receives reward in kind, unhusked paddy from the employer. It is worth noting here that wage labour is perceived as a sort of help with close resemblance to čhoi or unpaid labour service as a form of co-operative labour. This implies that wage labour is still inseparable from the deferent form of co-operative labour in the peasant consciousness, and is likely to be a transformation from the latter. In addition to this, the fact that the traditional form of payment by paddy is still of wide prevalence,[31] gives wage labour the character more of a social relationship between the hired and the employer, which is distinguished from a transaction utilising the medium of money.

It should be noted, however, that despite such a close linkage between wage labour and the dependent form of co-operative labour, the former has increasingly become a more purely economic transaction between the hired and the employer's household. This tendency can be particularly observed in the employment relationship between professional rural labourers or khon hap čhang, the growing mass of rural proletarian in recent years, and the rich operating households who employ them.

In Ayutthaya village, on the other hand, substitution of wage labour was made earlier, to a considerable degree in the period of initial reclamation at the turn of the century. Since then, wage labour has not been complementary to co-operative labour, but a major structural component of labour utilisation in Ayutthaya's broad-cast-sowing cultivation needed to cope with rapid reclamation and an extensive area operated. In the village, in similar terms to the modern Lannathai usage, rap čhang (the hired) means rural labourer. There are, in addition, a couple of dichotomous terms more commonly used to identify workers on an operating plot: khaek literally guest, specifically denotes a guest worker in labour exchange, and khaek čhang means hired guest. Those who come to help or chuai under the subordinate relationship of labour service are also classified in the former. With such a dichotomy, Ayutthaya's labour utilisation has shown a clear distinction between co-operative labour, including labour service, and wage labour, probably since the beginning of its history.

In contrast to the Intermontane Basin farming region, the social and economic environment of the Ayutthaya area since the turn of the century has been really quite a dynamic one involving not only rapid settlement and reclamation, but also the massive flow of seasonal migrant labourers from Isan or the North-East region. In the newly

opened frontiers for rice cultivation, the Eastern part of the Late Canalled Lowland and the Retarding Basin, including the Rangsit canal area and the areas near Ayutthaya city in particular, became a target for the North-Eastern migrant labourers in those periods.[32]

In Ayutthaya village up to the 1960's, migrant labourers mainly came from such North-Eastern provinces as Roi Et, Kalasin, Mahasarakham, and Nakhon Ratchasima. They were, according to the old villagers, led by contractors called nai khaek (foremen of guest worker) and were employed in harvesting, staying at a temporary field hut (kratop) in the Tontan field. In addition to those employed temporarily in harvesting, there were a limited number of luk čhang or labourers regularly hired for a season who lived in the employer's households (all were provided with meals and places to sleep). The nai khaek, who were mainly peasants of North East origin, gathered a number of migrant labourers coming from various areas of the North East at Khorat (Nakhon Ratchasima), from which they travelled together in search of jobs to various localities in the delta region. The nai khaek made contracts for piece work with operating households and collected a fee of 1 to 2 baht from the labourers under their supervision.

After the late 1960's, however, the supply of wage labour in the Tontan field and adjacent areas has completely changed. Since then, migrant labourers from some northern provinces of the delta region (Singburi, Chainat, Saraburi, and Lopburi) and from further to the north from provinces outside the delta (Nakhon Sawan, Sukhothai, Phičhit, and Phitsanulok) replaced labourers from the North East, some of them arriving even in the mid-1960's. This seems to be closely related to the evidence that the rapid expansion of upland cashcrop cultivation, particularly of maize, in the provinces of the north

Central Plain around 1958-60, resulted in the emergence of a growing population of poor peasants, seeking casual employment in the major rice production areas.[33] In 1974 and the few years following, a greater part of the seasonal migrant labourers working in the Tontan field were mainly upland cultivators from these provinces, and to a lesser degree, rice cultivating peasants from the northern part of the delta. Perhaps, another reason for the change is that the flow of seasonal out-migrants from the North East moved much more towards Bangkok metropolis in the 1960's. However, despite such rapid changes in the supply areas of seasonally migrant labourers, the relationship between the operating household and the wage labourer remains basically unchanged. Although the nai khaek as contractors are today mainly poor peasants who live in the village or adjacent areas, they still take a middle position between the two, as was the practice in former days.[34]

Thus, despite the change in the late 1960's, the heavy dependency on seasonal migrant labourers in the operating households of Ayutthaya village, is basically constant throughout its history. There has been some sort of labour market since the turn of the century, in which most operating households have been involved. In contrast to Chiangmai's subsistence production where wage labour has been basically supplied by the peasants inside the village, or from adjacent villages, a greater part of Ayutthaya's supply has been obtained through the labour market extending to an inter-regional scale. Under such circumstances the exchange between operating households, nai khaek as contractor, and labourers has been mostly carried out on a cash basis, contrasting with the payment in kind in Chiangmai village. The only exception is for the labourers who may be peasants in the same village or from villages nearby, who have close relations with operating households;

they were sometimes paid in paddy, but this type of payment had completeley disappeared by 1970. It can be, thus, asserted that the conditions of wage labour in Ayutthaya are qualitatively different from those of Chiangmai village, under the strong penetration of the money economy and the constant existence of a labour market, and its distinctiveness from co-operative labour has widened up to the present.

Bearing in mind these sharp contrasts in the historical and contemporary characteristics of wage labour between the two villages, we may now examine in more detail the method of wage payment, supply conditions of wage labour, and the form of wage work in comparative perspective. Table 43 shows these elements according to the basic stages of farming operations, comparing the two villages, and Table 44 shows current wage rates and their associated conditions in 1974-75.

Among the 112 households surveyed in Chiangmai village, a considerable number of households are already involved in use of wage labour, particularly in threshing and other labour-intensive stages. As we have already noted the predominant method of wage payment is in kind by unhusked paddy at most farming stages. The only exception is at threshing, in which dek čhang ti khao (minors hired for threshing paddy), i.e. younger men and women, gather to be hired by most operating households for both the pleasure of social intercourse and trifling pocket money. This particular form of wage labour implies that, despite the cash wage payment, the stress is laid much more upon forming intimate social relationships with other young people. It can be said that, despite the cash medium, Chiangmai's wage labour is still inseparable from social intercourse of a kind which is never observed in developed capitalist production and even in Ayutthaya's highly commercialised peasant economy. However, we have to bear in mind also the fact that

TABLE 43: Allocation and Supply of Wage Labour in the Farming Stages of the Two Villages, 1974-75

Farming stage	Chiangmai Village			Ayutthaya Village					
	Transplanting culture			Broadcast-sowing culture			Transplanting culture		
	No. of households (%)	Amount of wage labour* (%)	Payment and supply**	No. of households (%)	Amount of wage labour (%)	Payment and supply**	No. of households (%)	Amount of wage labour* (%)	Payment and supply**
Land preparation	9 (8)	198 (6)	Kind Inside	16 (37)	72 (2)	Cash Outside			
Sowing/nursery culture	3 (3)	29 (1)	Kind Inside						
Uprooting/ transplanting	75 (67)	742 (20)	Kind Inside				9 (60)	184 (30)	Cash Inside
After-cultivation									
Harvesting	77 (69)	1177 (32)	Kind Inside	36 (84)	3814 (87)	Cash Outside/ inside	11 (73)	310 (51)	Cash Inside
Bundling/ hauling	68 (61)	537 (15)	Kind Inside	13 (30)	427 (10)	Cash Inside/ outside	3 (20)	112 (19)	Cash Inside
Threshing/ hauling	98 (88)	946 (26)	Cash Inside	4 (9)	72 (2)	Cash Inside			
Total		3629			4385		15	606	

* Amount of wage labour input is given in man-days.

** Kind: Payment by unhusked paddy, normally at the rate of 1 thang/man-day in Chiangmai village.
Cash: Payment in cash at various rate.
Inside: Wage labour from inside the village or the villages nearby.
Outside: Wage labour from outside the village, mainly supplied by seasonal migrant labourers.

Source: 1974-75 Survey.

TABLE 44: Wage Rates of Various Tasks in the Two Villages, 1974-75

Farming stage	Wage rate in Chiangmai village	Wage rate in Ayutthaya village	
	Transplanting culture	Broadcast-sowing culture	Transplanting culture
Land preparation	DL K 1 thang/man-day PW K 7.5 thang/rai (Buffalo rental) PW K 10 thang/rai (Power-tiller rental)	PW C 30-35 baht/rai (Tractor ploughing service)	
Sowing/nursery culture	DL K 1 thang/man-day		
Uprooting/ Transplanting	DL K 1 thang/man-day PW K 1 thang/rai (Transplanting) PW C 20-30 baht/rai (Transplanting)		PW C 20 baht/100 bundles (Uprooting) PW C 80-100 baht/rai (Transplanting)
Harvesting	DL K 1 thang/man-day PW K 1 thang/rai PW C 10 baht/rai	PW C 60-80 baht/rai	PW C 60 baht/rai
Bundling/ hauling	DL K 1 thang/man-day PW C 1 baht/100 bundles	PW C 30-40 baht/100 bundles (Bundling) PW C 30 baht/100 bundles (Hauling)	PW C 30 baht/100 bundles (Bundling)
Threshing/ hauling	PW C 1-2 baht/100 bundles	PW C 30 baht/100 bundles (Power-tiller threshing service)	

PW: Piecework basis
DL: Day-labour basis
K: Payment in kind by unhusked paddy
C: Payment in cash
Farm-gate price of unhusked paddy in Chiangmai village, 1975 was 15-18 baht/thang.

Source: 1974-75 Survey.

such relationships between the operating household and the younger people is obviously governed by the unequal and respectful aspects of pi nɔng kan relationship as we have seen in regard to exchange labour.

In relation to this confirmation of the position of wage labour in village society and its social relations, we have to note the major supply source of wage labour. As shown in Table 43, the major supply is from inside the village, in contrast to the seasonal supply of migrant labourers in Ayutthaya village. Chiangmai's social solidarity in the production process seems to be quite rigid, as indicated with respect to the degree of the integration as a village community in Chapter V. This development of a closely knit community, however, seems to lead to other aspects of labour utilisation.

There is a radical discrimination exercised by the villagers against the group of newly settled poor peasants, who are mainly Christian, living on the eastern pae within the village territory.[35] These rural labourers' households have been unable to obtain any work in Chiangmai village's fields, even at the times of peak labour demand. Having few relations with other villagers, except with the poorer sector of Buddhist peasants, they have to earn a slender livelihood by casual employment in orchards owned by urban capitalist developers. And more seriously, they are developing their own small-scale occupations such as the gathering of tüng leaves, charcoal burning and wood cutting on the state's 'forest reserve' or pa sanguan, in which they are in conflict with the government's land-use policy. It can, then, be said that up to the present Chiangmai's integration as a village community has led to the use of wage labour, exclusively drawn from those with kinship ties and other traditional links within the community. On the other hand, the ostracised rural labourers newly migrated to the village seem to form a

new category of rural proletarians together with a few other rural labourers emerged from the original community.

Another point which should be noted in Chiangmai's wage labour utilisation is the predominance of day-labour rather than piece-work as the basis of contract, as shown in Table 44. Day-labour in a peasant agrarian society, generally speaking, is not based on time reckoning in the strict sense, allowing workers much flexibility in carrying out their work.[36] In Chiangmai's case, it may commonly be observed that the workers hired on a day-labour basis in transplanting or harvesting, carry out their allotted tasks but often leave for leisurely rests such as for fishing and general conversation without any strict supervision by the employer. After the day's work, when the employer's household invites partners under the ao mü sai mü labour exchange system involved in the same work to the evening feast and the hired labourers are also, in many cases, allowed to join in. With this flexibility in day-labouring arrangements and with no clear demarcation between wage labour and co-operative labour, Chiangmai's utilisation of wage labour is distinguishable from that of Ayutthaya village where the piece-work basis of wage labour is predominant. In Chiangmai's subsistence production, work and leisure appear to be intermingled even in wage labour.

On the other hand, Ayutthaya's utilisation of wage labour is more deeply monetised and related to the formal labour market. Among the 43 households cultivating broadcast-sown rice in the village, the greatest concentration of wage labour input is at harvesting, in which 87 per cent of the total wage labour input was made in 1974-75. In the transplanting method, a considerable number of households hire wage

labour both at the uprooting-transplanting and harvesting stages (Table 43). The method of wage payment is exclusively in cash at every stage of farming, regardless the method of cultivation, as shown in Tables 43 and 44. The wage rates are considerably higher than those in Chiangmai village. Although the rate is of course, highly variable, depending on tasks undertaken and between years, Auytthaya's ongoing wage levels amount to approximately 30-40 baht if computed on a per day basis,which is still considerably lower than the return to domestic labour and probably lower than wages in the industrial sector in Bangkok. This low wage-rate is likely to result in the increasing use of wage labour as a substitute for disappearing co-operative labour and even for the marginal units of domestic labour in the rich operating households.[37] In deciding prevailing wage rates there is a notable tendency for a few rich households, mainly landlord-operators and owner-operators, initially to fix the new wage levels for various tasks in a particular year, with these rates being subsequently followed by other operating households. In this connection, the nai khaek performs no role, remaining merely a contractor and a collector of wage labourers to be supplied to the operating households. The lower wage rates in Ayutthaya village thus seem to be derived from a form of monopsony control over wage labour exercised by the upper strata of landed peasantry. They are able to reduce the wage rate considerably from the level to be expected in a fully competitive labour market as developed in a capitalistic economic system.[38]

Such relatively low wages, paid in cash, under Ayutthaya's petty commodity production exhibit a sharp contrast with Chiangmai's traditional wage paid by unhusked paddy. The wage rate of one thang for one man-day of labour in Chiangmai village is almost ubiquitous and has

remained unchanged for many decades, probably for more than a century, regardless of any change in paddy price.[39] The traditional computation of one thang paddy per one man-day labour is principally based on use-value. This traditional wage rate may have been adjusted to the cost necessary to maintain subsistence for a labourer in former days. However, it is also true that this long-maintained, fixed rate certainly results in keeping wages low, which helps operating households of landed peasants to exploit the labour power of wage labourers. On the other hand, under Ayutthaya's commodity production, wage labour has become completely subject to exchange value. However, despite the long persistence of peasant petty commodity production, the underdevelopment of the labour market characteristic of peasant agriculture serves to reduce wage-rates to levels lower than would be attained in an industrial economy and in more capitalistic farming.

In relation to the supply conditions for wage labour in Ayutthaya village, we have already discussed the predominance of seasonal migrant labourers. In addition, a considerable number of wage labourers from inside the village are also hired, particularly in some stages of transplanting cultivation, and, to a lesser degree, in the harvesting and bundling stages of broadcast-sown cultivation. There can be observed a clear division in wage labour supply between the two methods of cultivation: to cope with the enormous demand for labour, particularly in harvesting, for the vast area of the Tontan field, broadcast-sowing cultivation has traditionally come to depend upon labour from outside the village in addition to supplementary labour from inside; the area operated under the early season transplanting cultivation is still small enough to be managed by the wage labour force from within the village. Most seasonal migrant labourers from

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the northern margins of the Central Plain, move southwards after they have finished harvesting in their own and adjacent villages. to be hired successively in the villages on the way. The lag in ripening time in different areas enables them to obtain temporary employment in various villages, and eventually they reach Ayutthaya area in December and January where khao khün man and other varieties with the latest maturation time in the delta are grown. Given this ecological connection in the seasonal migration pattern, outside labourers are rarely available in the period of early season cultivation lasting from April to September, and labour requirements are almost totally furnished by wage labourers from within the village.

In contrast to Chiangmai village, the contract for work in recent years has come to be made exclusively on a piece-work basis (čhang mao) for wage labourers from both inside and outside the village. Under a developed capitalist economy, piece-rates can be equated with time-wages in the economic sense.[40] However, in making a comparison of Chiangmai's day-labour and Ayatthaya's piece-work systems, we have to take into consideration differences between the two dominant forms within the context of peasant agriculture.

In Chiangmai's subsistence oriented production, day-labour wages at every stage of cultivation are, of course, measured by time, but there is no strict reckoning of working-time and little supervision is made, allowing flexible use of time by the labourer. This indicates that Chiangmai's peasant farming still retains the irregularity of working pattern characteristic of subsistence production, despite the prevailing day-labour wage which is apparently similar to a capitalist form. On the contrary Ayutthaya's wage labour, based on piece-work, is a much more advanced one in which exploitation of labour power is

exercised in a more efficient form. In the harvesting of broadcast-sown rice, for example, the rate of wage from 1974-75 varied from 15 to 20 baht per ngan (0.25 rai), or equivalent to 60 and 80 baht per rai respectively, depending on conditions, such as lodged stalks or water remaining in the plot. A worker can normally harvest 1-1.5 ngan on average, or if particularly skilled 2 ngan in a day; at the very most he could do as much as 3 ngan, to earn a maximum 60 baht a day. Since most seasonal migrant labourers are hired as a group to undertake a piece of work in harvesting, they are able to concentrate labour power and skills on the piece of work contracted, regardless of differences in ability among the members. In so doing, the working time of the labourers tends to be unusually extended, possibly up to 12 hours a day to finish the piece of work within a limited time. Under the prevailing basis of piece-work wage, working time is often prolonged and labour use extremely intensive. The flexible use of time as practised within Chiangmai's subsistence production is absent. In this way, the piece-work basis enables the operating household as an employer to achieve an efficient input of relatively cheap wage labour at the critical stage when a great labour-intensity is required.

5. Conclusions

In the preceding discussions, we have attempted to show the nature of labour utilisation in relation to the production process of rice cultivation, comparing the cases of Chiangmai and Ayutthaya villages. As indicated in the analysis of farming operations in the previous chapter, Chiangmai's transplanting culture shows an extremely high total input of labour per unit area, with particular emphasis on the harvesting and uprooting-transplanting stages. This is in radical

contrast to Ayutthaya's broadcast-sowing culture where the total labour input per unit area is relatively lower and a greater amount of it is concentrated only on harvesting. These contrasts in total labour input per unit area and in the pattern of allocation to different farming stages are principally derived from the underlying technological differences in the production process between the two cultivation methods predominant in the villages.

With respect to the allocation patterns of labour resources, we have to recognise, in addition to the domestic labour of each operating household, the great significance of supplementary labour resources, i.e. co-operative labour and wage labour, which are almost essential in the ecological and technological context of rice farming. The major inputs of such supplementary labour resources are concentrated on the labour intensive stages of the respective cultivation methods. There is, however, a profound contrast in the relative mobilisation of co-operative labour and wage labour resources between the two villages. Chiangmai's transplanting culture and its subsistence oriented production still utilises a greater amount of co-operative labour organised through traditional social norms and social relations of production to meet the supplementary demand. In Ayutthaya's long-developed petty commodity production, the use of wage labour, already prevalent even in the pioneering days, has always performed an important role, while the always relatively underdeveloped co-operative labour is now disappearing, being substituted by wage labour. Despite such a radical contrast in the mobilisation of non-family resources, a disparity common to both villages can be detected in the relative availability of non-family resources between land tenure categories. The upper strata of operating household are increasingly able to

secure wide access to non-family labour resources, with the lower strata conversely tending to depend much more upon domestic labour.

It can be thus asserted that the basic patterns of labour utilisation are generally structured within a particular production process in which the peasants' unique and long-established technology has interacted with the particular set of ecological factors in rice cultivation. In addition to this technological and ecological system, the patterns of labour utilisation, especially in mobilisation of non-family labour resources, have obviously resulted from the particular socio-economic conditions of peasant production, evolved in the two selected villages, namely subsistence production in Chiangmai village, and petty commodity production in Ayutthaya village.

Assuming such structural relationships working between ecological and socio-economic conditions, thus we have to approach the socio-economic reality of utilisation of non-family labour resources with regard to the social relations of production. In this connection, the distinction in terms of social relations between the two forms of co-operative labour, exchange labour and labour service, is of significance. Exchange labour, a reciprocal transaction practised between those of equal or near-equal status, has performed an important role in labour mobilisation among the rather lower strata of peasants. Conversely, labour service, a dependent and exploitative relationship, is often established between households of different status, emphasising the disparity between the rich or senior and the poor or junior.

Given the social relations underlying the co-operative labour consisting of two such distinctive forms, the two villages again show a sharp contrast. In the subsistence context, Chiangmai's peasants

have still retained both forms of co-operative labour, together with their highly co-operative scheme of irrigation. This implies that the direct exchange and exploitation of labour power based on reciprocity and dependency are still widely practised without the mediation of money. By contrast, Ayutthaya's co-operative labour, which was rather underdeveloped from the start, is now completely shifting to wage labour. Exchange and exploitation have become, here, no more intimate, but are practised and exercised almost exclusively through the medium of money.

The contrast in terms of social relations of production can be further clarified when we take into consideration the conditions of wage labour in the two villages. Aspects of wage labour utilisation such as method of wage payment, supply conditions, and forms of wage work, indicate quite different conditions between the two in regard to the relationship of wage and co-operative labour. In Chiangmai's subsistence production wage labour is complementary to and even inseparable from co-operative labour, retaining practices of payment in kind and a basis of day-labour in which work and leisure is still intermingled. On the other hand, in Ayutthaya's petty commodity production, wage labour, quite separate at an early stage from any form of co-operative labour, has prevailed on a piece-work basis with payment in cash and the extensive use of sources of labour from the wider labour market.

There is still doubt that these contrasting characteristics of social relations in co-operative labour and wage labour are basically derived from the particular socio-economic conditions of peasant production existing in the two villages. Assuming these contrasting orientations of peasant production - subsistence production and petty

commodity production - are structurally linked with the particular processes of production, we can assert that the social relations currently observed have been formed in close relation to the peasant technologies of rice cultivation respectively developed within the two villages. The distinctiveness of the two peasant farming systems, which we have examined at the regional level, seems to assume greater clarity in the context of the village community.

CHAPTER IX

CONCLUSIONS: PEASANT FARMING SYSTEMS IN THAILAND

In this final chapter we first intend to summarise the foregoing discussions in making a re-examination of our major hypotheses postulated earlier. In making a comparison of the two farming systems, we examine our findings and arguments with special reference to such ecological factors as physiographic and hydrological conditions, irrigation and cultivation methods. This is followed by a comparison in terms of the differing socio-economic context extending to the historical processes of land reclamation, land tenure and labour utilisation. Throughout the summary discussions, our emphasis will be laid upon the two structures, ecological and socio-economic, underlying the peasant farming system. Subsequently we shall investigate the role of peasant technology in an attempt to place it in a theoretical context within the structure of a farming system and suggest some issues relevant to studies of peasant farming.

Our inquiry has mainly focused on the nature of peasant farming, which has been examined as a system in both ecological and socio-economic contexts. In order to achieve a systematic interpretation of peasant farming, our description and analysis have placed emphasis on both, rather than concentrating solely on ecological explanations. The reality of rice cultivation practised by Thai peasants presents far greater complexity in its linkage to economic, social and cultural aspects, than any naive ecological hypotheses would assume. Another methodological stress made in the present study is the comparative perspective designed to show contrasts between the systems, and to detect the more significant and vital factors and relations within them. A comparative perspective is considered useful, if not essential, when we attempt to elucidate the overall details of a structure such as a farming system, in which a number of factors are interrelated. The complex entity of a farming system consisting of ecological and socio-economic aspects, can be analysed most effectively, only through a comparative investigation of different systems.

Within such major theoretical and methodological considerations, we have posed at the start the two main hypotheses concerned with the ecological and socio-economic aspects of the two distinctive farming systems as follows:

(1) The two peasant farming systems, i.e. the Intermontane Basin type and the Delta type, show radical contrasts in irrigation and cultivation methods in relation to ecological and technological conditions.

(2) These two farming systems, in which agricultural technology structurally interacts with both ecological and socio-economic conditions, are dominated by distinctive forms of peasant

agricultural production: subsistence production in the Intermontane Basin and petty commodity production in the Delta.

In dealing with these hypotheses, we have set out arguments at the regional level to show the main characteristics of the farming systems. Since, however, the elements and relationships in peasant farming essentially relate to individual households as production units within their immediate framework of the village community, the main part of our investigation has subsequently focused on two selected villages each representing its farming region. It is at this level that the complex structural relationships between ecological and socio-economic conditions in a peasant farming system can most explicitly be exposed.

On this basis we can now bring together the threads of arguments in the preceding chapters in an attempt to elucidate the nature of the farming systems in a comparative manner. Our examination of the operation of the rice farming systems of the two areas has shown clearly significant differences in the nature of the systems included within the general typology of irrigated rice farming. These differences are derived from both ecological and socio-economic environments, expressed in the medium of farming technology.

As we have seen in earlier chapters, the physiographical and hydrological conditions around the two villages differ greatly, particularly as to the water availability in the first half of the cultivation period, the crucial time of vegetative growth for the rice plant. The rice fields of Chiangmai village and of many parts of the intermontane basins, stretching over alluvial plains with moderate slope along relatively small-scale rivers, with a high catchment/paddy

area ratio, have the possibility of a sufficient and stable water supply, if peasant technology is able to manipulate the water resources by small-scale irrigation works. On the other hand, the rice fields extending over the low-lying and extremely flat delta terrain are, in many localities, subject to annual inundation which is uncertain in timing and amount, but which normally occurs in the latter half of the cultivation period. In particular, the vast depression of the Retarding Basin, in which Ayutthaya village is located, is submerged under a deep and prolonged inundation. This uncontrollable inundation together with the uncertainty of monsoon rainfall during the first half of the period, has made effective water control practically impossible for the majority of the peasants within the scope of indigenous technology.

Under such radical contrasts in physiographical and hydrological conditions, the methods and practices of supplementary irrigation, which constitute the crucial farming technology of rice cultivation, differ to a considerable degree between the two villages. Chiangmai's peasants have traditionally been able to create and develop within the limits of their indigenous technology a highly artificial irrigation system, i.e. the müang fai system. With the müang fai system held as common property, efficiency in irrigation is here attained through highly co-operative organisational arrangements in allocation of water rights and in necessary maintenance under the customary regulations. On the contrary, the gigantic and uncontrollable nature of the delta hydrology has meant that Ayuttaya's peasants depend almost totally upon monsoon precipitation and annual inundation. Without any traditional organisational arrangement for irrigation, Ayutthaya's rice farming has recently been involved in a large-scale government water control project in which not surprisingly there is

little peasant participation. Thus the physiographical and hydrological conditions have a vital effect upon the very core of peasant farming technology in rice cultivation, with different practices of irrigation generally observable between the two farming systems.

These contrasting ecological complexes are reflected closely in the different cultivation methods predominant in the two villages. Chiangmai's elaborate transplanting culture can be attained only through the well developed water distribution system within the müang fai system. Conversely, Ayutthaya's extensive broadcast-sowing culture requires no systematic distribution of water but does require careful timing of various farming operations to adjust to the occurrence of monsoon precipitation and flooding. In the regional context of this latter farming system, the predominance of broadcast-sowing observed in Ayutthaya village is not necessarily applicable to the whole Delta region where transplanting has historically been practised, though in rather limited areas under more favourable water conditions, and where there has been a shift from broadcast-sowing to transplanting recently along with the government water control projects. We should note, however, that many peasants who have recently adopted transplanting cultivation tend to be rather indifferent to maintenance and other managerial tasks required in irrigation as a whole. This implies that the Delta farming system still retains a strong inclination towards dependence on uncontrollable natural forces to which broadcast-sowing culture is a more flexible response as typically expressed in Ayutthaya village.

Thus, the general issue of ecological complexes in relation to physiographical and hydrological conditions, irrigation methods and rice cultivation methods obviously calls for differential responses

of the peasants between the two farming systems. Given the relatively controllable land and water resources associated with rice farming, Chiangmai's peasants have consistently made a series of highly active responses, represented by the artificial and indigenous engineering of the müang fai system and by a sophisticated transplanting culture. On the other hand, uncontrollable nature and water resources in the delta have imposed on Ayutthaya's peasants relatively passive responses in almost every aspect of their rice farming. We should note, however, that these apparently passive responses towards nature have, on the other hand, led the peasants to the other flexible technological responses shown in the deliberate choice of seed varieties including 'floating rice' and operations whose timing is well adjusted to the monsoon rains and inundation. So far as the ecological complexes and their embodied peasant responses are compared, differentiation between the two farming systems is clearly justified. What we have suggested in our first working hypothesis as a point of distinction between peasant farming systems, the effect of ecological differences, does indeed partly explain the responses in rice farming among Thai peasants.

Recognising these radical contrasts in the ecological complexes, it is now in turn necessary to make a further examination of the second working hypothesis, with particular reference to several socio-economic aspects involved within the two rice farming systems. As we have suggested throughout the preceding pages, it is peasant farming technology which interacts between the ecological and socio-economic structures, or sub-systems, of rice farming. Within this conceptual framework, peasant farming technology as it relates to the ecological structure is only one element of importance and it must be re-examined in relation to the socio-economic structure. We would argue that such

a twofold analysis should be utilised in any study of peasant farming in order to overcome naive 'deterministic' interpretations on the basis of environmental and technical factors and, moreover, functional interpretations of cultural ecology, which largely play down socio-economic structure.

In our empirical analysis preceding in earlier chapters, there is little doubt that historical processes of riceland reclamation differ markedly between the two villages and in more general terms between the two farming regions. In Chiangmai village small-scale reclamation by the peasants of the limited land resources in the narrow valley proceeded gradually from the early nineteenth century, and the closure of the land frontier in the 1950's has led to serious landhunger at the present time. The quite small area operated by all households, whether landowners, tenants or part-tenants, has necessitated the development of an extremely sophisticated and labour-intensive farming technology designed to increase land productivity, through an efficient manipulation of physical factors and social relations of production. Despite this high productivity, however, Chiangmai's peasant production has been historically and is still directed towards subsistence, aiming at securing rice for home consumption, despite the entry of the money economy in recent years. Ayutthaya's historical situation is a clear contrast. Here peasant farming started, as widely seen, particularly in the Young Delta, with large-scale reclamation of the barren delta associated with the boom in rice-export agriculture at the beginning of the twentieth century. Peasant reclamation generally ceased by the 1920's or 1930's and thereafter landlessness among the peasants has steadily increased. Ayutthaya's less labour-intensive technology has been working efficiently throughout the reclamation period up to the

present, coping with the need to operate relatively large areas under almost uncontrollably harsh natural conditions. Throughout the relatively large areas cultivated and with its extensive farming techniques, Ayutthaya's peasant production has long been able to carry on petty commodity production, with a deep involvement in the rice market economy.

With respect to the land tenure situation, the contrasts of the two farming systems become even clearer, reflecting as it does the differences in land reclamation processes. In Chiangmai village, the close of peasant small-scale reclamation and the continuous subdivision of landholdings for many generations has led to an absolute shortage of land. This has resulted in the development of an intricate pattern of small-scale renting of landholdings, which is practised both between kinsmen and non-kin households mainly within the village. On the other hand, in Ayutthaya's petty commodity production developed initially through the large-scale reclamation boom going back only two generations, the landed peasants have still retained relatively large holdings. However, the tendency towards landlessness and tenancy has steadily progressed throughout Ayutthaya village's history, where the development of absentee landlordism has been one of the major characteristics. Despite such a difference in the dominant form of tenancy, the two villages, and probably most parts of the two farming regions, have generally undergone a rapid differentiation with distinct land tenure categories, particularly as relates to landed and non-landed households, during the past few decades. Above all the growing mass of landless rural labourers, who remain within villages to be hired as wage labourers by the richer operating households, can be generally regarded as a result of the ongoing socio-economic stratification which

has accelerated particularly since the 1960's. It might indeed be said that landlessness and socio-economic stratification among the peasants, which cause a serious increase in rural labourers, are currently progressing regardless of differences in farming system, though the processes vary in degree with the area.

Another important socio-economic aspect of the peasant farming systems is labour utilisation in the production process, with which the underlying technological factors interact most explicitly. In particular, the series of farming operations embodied in a particular cultivation method principally governs the pattern of labour utilisation. The extremely high labour input per unit area with particular emphasis laid on the uprooting-transplanting and harvesting stages in Chiangmai's transplanting culture and the lower input concentrated only at the harvesting stage in Ayutthaya's broadcast-sowing culture explicitly reflect such a structural relationship between technology and labour utilisation. In addition to this, a striking contrast between the two farming systems focuses upon utilisation of non-family labour resources, co-operative labour and wage labour, which are an essential element of rice cultivation. The great significanace of co-operative labour, including both exchange labour and labour service, in Chiangmai village clearly indicates continuing social relations of production between the villagers. Conversely, Ayutthaya's co-operative labour has been almost completely replaced under the influence of the long-established money economy by wage labour, which no longer involves personal, non-monetary relationships in labour exchange. This contrast in labour utilisation appears to indicate distinctive forms of peasant agricultural production, which have been generated and developed in the two farming systems and their regions.

Thus, the general issue of socio-economic conditions, which we have compared above, including the processes of land reclamation, the land tenure situations and patterns of labour utilisation, obviously indicate the differential orientation of peasant production economy, as we have postulated in the second working hypothesis. Chiangmai's subsistence production has developed within a relatively closed village community away from the rice market economy. It has basically been achieved on quite small operated areas through extremely high labour inputs and a sophisticated peasant technology directed towards alteration of land and water resources. Deterioration of the land tenure situation leading to the small-scale renting generally practised within the village and wide utilisation of co-operative labour are also characteristic to the subsistence oriented production. On the other hand, Ayutthaya's petty commodity production, which started and has continued principally with rice-export agriculture, has been achieved over larger operated areas through lower labour input and an indigenous peasant technology still rather dependent on nature. As we have seen earlier in the development of absentee landlordism and the striking prevalence of wage labour, it has been linked closely with the wider economic context of rice-export agriculture in the delta.

It should now be noted that these distinctive forms of peasant production, which clearly stem from the complex socio-economic conditions, are again bound up with the ecological structure we have described earlier. The persistence of active responses towards alteration of the natural environment and great sophistication of the entire farming process must be fostered and emphasised within Chiangmai's subsistence production, where traditional social relations of production and the associated social norms have still been retained within the village

community. Despite the recent rapid penetration of external forces such as the money economy and the introduction of industrial inputs, Chiangmai's peasants still seem to maintain their own subsistence context. In contrast to this, Ayutthaya's situation is quite different. The rather passive but highly flexible responses, which are consistently recognisable throughout the process of rice farming, have long been a component of petty commodity production among the delta peasants. Such responses together with the individualistic nature shown in their farming operations are considered to have emerged after the destruction of subsistence production and its associated socio-economic relations, and to have been established along with the prevalence of rice-export economy.

Throughout the present study our arguments have mainly taken a twofold analytical path, ecological and socio-economic, in order to tackle the complex entity of Thai peasant rice farming as a system. In so doing, we have identified two distinctive farming systems of rice cultivation, in which peasants, coping with the given physiographical and hydrological conditions, have utilised different methods of irrigation and cultivation to lead to a successful production process. These farming systems, at the same time, are dominated by different forms of peasant production in terms of their current socio-economic situation. As a consequence, we can now argue that what we have pursued under the term 'peasant farming system' is indeed a technological complex linking the two interrelated sub-systems. Given that technology essentially embodies socio-economic relations and the prevalent thought and behavioural response among peasants, as well as implements such as the plough and sickle, a technological complex is a totality reflecting such a farming system itself.

Thus, in our study of Thai peasant farming systems we have attempted to demonstrate this simple but fundamental principle. It can be asserted that a farming system as a technological complex is a reflection of a decision-making process by a peasant, extending to both ecological and socio-economic contexts relevant to rice cultivation. It is peasant technology per se which combines the various factors in both contexts and integrates them into a consistent system of rice farming. Through the mediation of peasant technology, the rice plant, physiography and hydrology - elements of nature itself, are altered and transformed into the effective environment, which, in turn, necessarily link with a particular set of socio-economic relations. For the peasants whether in Chiangmai or in Ayutthaya, technology is not an abstract concept of which only a geographer may think, but a concrete reality through which they decide and act towards water conditions, plants, land and labour.

It can, then, be suggested that studying the range of various farming 'techniques', as we have demonstrated in detail in this study, may provide an extremely powerful tool in identifying the processes of peasant decision-making behind them. Farming techniques mobilised in cultivation, including seeds, plants, farming tools, motive power and other technical apparatus, and their usage and performance each have a particular meaning in the ecological and socio-economic contexts. In other words, they always represent a particular function within a consistent and systematic process of peasant production; an individual tool and its usage have a specific position within the technological complex. For this reason, a detailed inquiry into techniques may enable a researcher to cast light on their underlying relationship to the peasant decision-making process in response to the natural and socio-economic

conditions surrounding him.

It is our strong assertion that every fieldworker who is concerned with a particular peasant farming cannot begin his study without an apparently simple but essential inquiry into such questions as to why the peasant maintains standing water on his plot to a level of 10 cm, not 20 cm, and why he sows 'floating rice', not other varieties. The water of 10 cm depth and the 'floating rice' carry amazingly rich implications and are often a clue for solving the entire problem involved in a peasant farming. It should be noted here that any attempts to categorise peasant farming at a highly abstract level, represented by conventional typology of the agricultural system, of environmental determinism, of functional cultural ecology and, more recently, of 'modes of production' theses, would be totally meaningless or, at the best a mere intellectual exercise, unless they were built up on the base of shared experience of peasant farming systems currently being derived from detailed research in the countrysides of the Third World.

In the present study we entered into little discussion of technical or technological changes, now going on in many localities of the two farming regions. However, some changes, at least those observable in the two studied villages, seem to be worth noting in relation to our theoretical framework of peasant technology. The first is the recent rapid expansion of upland cropping by shifting cultivation techniques in dry deciduous dipterocarp forests, which are in many parts regarded as state-owned 'forest reserve', in the Intermontane Basin region. The cultivators of the upland are mostly landless peasants, including rural labourers and poor tenants, who seek subsistence rice for their survival. Their reclamation and

techniques are not a regression from existing techniques, but a development of the peasant subsistence technology per se which is currently establishing itself outside the existing wet-rice farming system. This is crucially significant in indicating that the problems arising in the socio-economic context, particularly those derived from the aggravation of the land tenure situation, can bring about a new technological complex.

The second is the shift from broadcast-sowing to transplanting, which is now proceeding widely in response to the improvement of water control under the government projects in the Delta. This externally-induced technical change accompanying the introduction of new seed varieties and a set of industrial inputs indeed has an effect upon the existing ecological complex. It is also true that changes have been effected, to a certain extent, in the socio-economic structure, particularly in the pattern of labour utilisation according to the new pattern of farming operations caused by the shift. To cope with the increased labour demand especially in the uprooting-transplanting stage, the households who have adopted the transplanting method in early season cultivation have become increasingly dependent upon wage labour, at least in the case of Ayutthaya village. However, this does not mean an emergence of a new pattern of labour utilisation, but only indicates the progress of the existing tendency towards dependency on wage labour. The dependency on wage labour has already existed within the socio-economic structure characteristic of the petty commodity production long-established within the Delta farming system. Moreover, the shift to the transplanting method is most unlikely to result in any changes in the land tenure situation.

It should be noted that the externally-induced technical changes involving a new set of inputs, which may merely cause a change in the ecological nexus of rice cultivation, does not necessarily bring about an overall structural change of a farming system. Conversely, the former case proceeding in the Intermontane Basin farming system may represent far more serious and dynamic changes,which represent indeed the eruption of socio-economic problems internally developed within a farming system.

These examples of the ongoing changes suggest a fundamental principle that peasant farming technology is not variable in itself but a totality. Therefore, adoption of techniques does not necessarily mean fundamental change that brings about changes in decision-making attitudes or, in other words, peasant consciousness directed towards both socio-economic and physical environments. But rather we can here assume, following Georg Lukács (Lukács, 1966: 29), that, among most peasants,problems first arise in the socio-economic sphere, which suggest the need for or allow for technological change, possibly in both ecological and socio-economic structures of the farming system.

NOTES

CHAPTER I

1. For example, Grigg's comparative surveys of farm-size and agricultural labour force on the world scale (Grigg, 1966: 204-235; Grigg, 1975: 194-202).

2. Hahn's attempt is made essentially in the context of cultural history. For further discussion on Hahn's contribution to the study of cultural history, see Kramer, 1967: 73-89.

3. In British geography B.H. Farmer lays stress on comparative technology (Farmer, 1968: 202-208).

4. According to Pelzer, landscape is a generic geographical concept which is "physical expressions of totally different economies, or mode of life, with different cultural patterns, concepts of land tenure, attitudes towards the soil, and material equipment" (Pelzer, 1945: 6). Also see Uhlig, 1969: 18.

5. If one considers the subsistence part of the household economy and nutrition, poultry raising together with fishing is one of the more important resources of protein supply in Thai life (Kamol, 1955: 54-55; Whyte, 1974: 147-148).

6. The major analyses of this study will be carried out in the spatial framework of the villages, but such a study of peasant villages must take into account the influence of the outside world. For discussion on the problems of village studies see Geertz, 1968: 318-322.

7. Janet Henshall provides an explanatory model to show a combination of farming systems in the tropics, and tries a structural analysis of Barbados peasant agriculture (Henshall, 1967: 433-434; Henshall and King, 1966: 74-84). R.J.C. Munton shows a decision-making model on the farm being viewed as both ecosystems and economic systems (Munton, 1969: 145-156; Morgan and Munton,

1971: 20-22), while I.G. Simmons' works are more widely concerned with the evaluation and management of various natural resources (Simmons, 1966; 59-72; Simmons, 1974). Recent trends of ecological study in geography, particularly in South East Asia, appear in some stimulating essays dealing with environmental perception edited by Philip Stott (Stott, 1978: 7-22; Ng, 1978: 34-48; Demaine, 1978: 49-67).

8. Blaut points out that "one of the reasons why we have so few explanatory generalisations about resource-using systems and their significance for culture ..... would seem to be the lack of attention on the part of geographers to the behavioural and orientational aspects of the fields, and of anthropologists to the material aspect" (Blaut, 1961: 58). Also see Mikesell, 1967: 631.

9. Besides geographical studies, some British anthropologists have laid strong emphasis upon environmental variables in their analyses of social structure, as a challenge to conentional functionalism. Edmund Leach's stimulating studies on Kachin and Shan political systems in highland Burma and social structure of Pul Eliya in Sri Lanka are chiefly based on ecological speculations; and his typology of 'valley state' in mainland South East Asia is also constructed on the ecological setting (Leach, 1954; Leach, 1961; Leach, 1960: 49-68). Peter Worsley's critique for Fortes' analysis of the Tallensi kinship includes suggestive discussions in ecological context (Worsley, 1956: 37-77). Daryll Forde's early work on material culture and environment marked a glimpse of the ecological approach in British anthropology, and leads to the theoretical foundation of 'socio-cultural ecology' in later years (Forde, 1949; Forde, 1970: 15-29). For further discussion of recent trends see Ellen, 1978: 290-303; Ellen, 1979: 1-17.

10. Harris points out that Steward and most of his successors neglected empirical studies of agrarian people in favour of non-agricultural hunting and gathering groups (Harris, 1969a: 135). However, the studies on peasant agriculture in Puerto Rico and the sustained theoretical concern on irrigated agriculture and its socio-political implications should be noted (Steward et al. 1955; Steward

et al., 1956).

11. Ethnoecology might closely be related to the concept of 'perceived environment' in geography (Brookfield, 1969: 53-80).

12. Such a typological logic of environmental relationship is also stressed and could lead to the formulation of a kind of technological determinism as in Wittfogel's theory of 'hydraulic societies' (Wittfogel, 1956: 152-153; Wittfogel, 1957: 11-22).

13. See criticism made by J. Kahn (Kahn, 1974: 7; Kahn, 1980: 61).

14. In a South East Asian context, ecological studies flourished especially on shifting cultivation with some distinguished monographs (Freeman, 1955; Conklin, 1957; Spencer, 1966; Sasaki, 1970; Geddes, 1976.
On the other hand, however, only a
few works have been carried out, including the studies of Geertz and Hanks, on the lowland wet-rice cultivation.

15. Bang Chan, a rice-growing village in which the Cornell Thai project has conducted intensive field studies since 1948 is situated about 35 km to the northeast from Bangkok. Besides Hanks' study the following works derived from this project are directly relevant to the study of peasant farming systems; (Sharp et al., 1953; Kamol, 1955; Sharp and Hanks, 1978).

16. Michael Calavan's study on peasant decision-making in a village in Chiangmai province of Thailand includes a detailed examination of ecological factors. Ortiz's study of Páez peasant economy in Colombia recognises the two different categories among Indians, the progressive and the traditional, in their decision-making, labour utilisation, marketing, and their production and consumption objectives (Ortiz, 1973: 177-180).

17. In his 'socio-cultural ecology' Daryll Forde indicates that "the main categories of phenomena between which interrelations of particular sets of variables are to be sought, may be distinguished as: bio-physical processes and conditions; technical apparatus and activity instrumentally related to these and institutionalised

modes of social organisation" (Forde, 1970: 26).

18. Marshall Sahlins critisises such a functionalism as follows: "The 'neo-materialism' seems analytically innocent of any concern for contradition - although it sometimes figures itself a client of Marxism (minus the dialectical materialism)" (Sahlins, 1969: 30).

19. Ronald Frankenberg indicates that such view of peasant economy stressed that its social system might correspond to the 'embeddedness' of Marx's concept of pre-capitalist economy (Frankenberg, 1967: 52-54).

20. For example, Chihiro Nakajima's marginal theory of the family farm in equilibrium (Nakajima, 1969: 165-184).

21. In recent examples, Mark Harrison examines and evaluates Chayanov's theory in the historical context of the formation and disorganisation of the peasantry (Harrison, 1977: 323-336), while Judith Ennew, Paul Hirst and Keith Tribe suggest that the concept of 'peasant mode of production' cannot be constructed through an examination of the works of Lenin and Kautsky (Ennew et al., 1977: 295-322). Also see Littlejohn's sociological criticism (Littlejohn, 1977: 118-156).

22. The following studies include the detailed analysis of the peasant household economy; in northern Thailand de Young, 1958; Kingshill, 1976; Turton, 1975; Potter, 1976, in the northeast Madge, 1957; Troger, 1960: 165-190; Long et al., 1963; Kamol, 1968; Mizuno, 1971; Dixon, 1974; Demaine, 1977; SOAS, 1978, in the Central Plain Kaufman, 1960; Kitahara, 1974: 20-42, 24-38.

23. Zimmerman's economic survey was carried out in sampled households from thirty-six administrative villages covering all of the country in 1930-31. This was followed by a second survey in 1934-35 by James Andrews (Andrews, 1935).

24. Chayanov earlier pointed out the relationship between the size of the holdings and the developing cycle of the peasant family, and stressed the demographic differentiation of Russian peasantry

(Chayanov, 1966: 60-68). Jack Goody also recently suggests that the existence of various types of domestic groups in a particular society often reflects different cyclical stages of a family (Goody, 1958: 53-91; Goody, 1976).

25. For example, see Wagner, 1960: 49-62; Clark and Haswell, 1964: 4; Hodder, 1968: 101-106; Symons, 1978: 166-172. Clark and Haswell especially emphasise the nutritional aspect of subsistence production (Clark and Haswell, 1964; Haswell, 1973: 47-52). For recent discussion of the relationship between 'subsistence production' and 'petty commodity production', particularly in Marxist context, see Kahn, 1978: 110-137; Kahn, 1980: 130-150; Long and Richardson, 1978: 176-209; Bernstein, 1977: 60-73.

26. For discussion of the development of peasant reclamation in the Chao Phraya delta, especially in the latter half of the nineteenth century and the beginning of this century, see Ingram, 1971; Johnston, 1975; Johnston, 1976: 27-44; Tanabe, 1978: 40-82.

27. For further discussion of the process of destruction of the subsistence economy in the Chao Phraya delta, see van der Heide, 1906: 74-101; Ammar, 1972. Chatthip Nartsupha and Suthy Prasartset give a highly systematic treatment of this process under the concept of 'dependent commodity production', making use of abundant primary documents in this period (Suthy and Chatthip, 1977: 144-167; Chatthip and Suthy, 1977; Chatthip and Suthy, 1978).

28. Some economists regard technology as an integral part of production factors, which include both material forms of capital and human agents. Theodore Schultz, thus, stresses the embodiment of technology in production factors: "A technology is always embodied in particular factors and, therefore, in order to introduce a new technology it is necessary to employ a set of factors of production that differs from the set formerly employed" (Schultz, 1964: 132).

29. Useful discussion of the concept of technology can be found, particularly in numerous works of the Frankfurt School. Also see

Marcuse, 1964: xiv-xv.

30. Anuman's ethnographical study, first published in 1948 was translated into English by William J. Gedney in 1956 (Anuman, 1961: 3-59).

31. In the 1960s the average land productivity which had been stagnant since the beginning of this century began to increase for the first time as the result of irrigation improvement and increasing modern inputs (Motooka, 1978: 300). Such achievements are, however, attained in rather restricted areas of the Chao Phraya delta, and consequently relate to a growing tendency toward landlessness and indebtedness, and growing inequality in control over means of production (Turton, 1978: 107).

CHAPTER II

1. For the concept of 'productivity' in the ecological context, see Harris, 1969a: 136-137.

2. The contribution of these blue-green algae may not be consciously realised among most peasants. In this connection, a highly suggestive discussion is made by M.M. Postan on the introduction of legumes among the medieval peasants in Britain as follows: "In many cases, however, beans and peas were grown merely because they were an important constituent of popular diet or good cattle fodder. The contribution which legumes could make to the success of other crops by replenishing the nitrates in the soil may or may not have been realised". (Postan, 1975: 57).

3. See the case of the Hongha (Red river) delta in Vietnam (Gourou, 1966: 16).

4. Credner gives the figure 1,880 mm (Credner, 1935: 212), while others give 1,778 mm (Dobby, 1958: 272; Pendleton, 1962: 138).

5. These physiographical regions basically correspond to Fukui's 'rice cultural regions' and to Kaida's 'agro-hydrological regions'. See Fukui, 1976: 145-156; Kaida, 1976: 167-180.

6. For the recent expansion of rice fields in relation to settlement patterns on the marginal fans, see Sternstein, 1965: 31-32.

7. For further discussion of the relationships between natural environments and the historical evolution of Thai societies in various regions of Thailand, see Ishii, 1978: 15-39; Takaya, 1975b:190-195; Tanabe, 1975: 70-94; Tanabe, 1978: 40-82.

CHAPTER III

1. In the 1977-78 cropping season the total area planted in wet-rice amounted to 3,810,770 rai (609,723 ha) (Thailand-Ministry of Agriculture, 1978: 16-19). Figures showing land utilisation in a relatively recent year (1971) are given in Thailand-Ministry of Agriculture, 1972.

2. The tong and thung, generally denoting an open field, are not a physiographical term but rather a term of vegetation.

3. In northern Thailand, dry deciduous dipterocarp forest is dominated by some deciduous tree species: ngae (Shorea obtusa), hiang (Dipterocarpus obtusifolius) and tüng (Dipterocarpus tuberculatus). For further discussion of this type of forest, see Stott, 1978: 165-175.

4. The forest products from pae include quite a wide range of materials for artifacts. For example, ñang hak (lacquer) extracted from hak luang (Melanorrhoea usitata) has been related to the development of traditional lacquer ware (khüang khoen) industry in this region as well as in the Shan States, Burma. The technology of the lacquer ware industry in Chiangmai is derived mainly from the old captives and migrants of Thai Khoen from Chiangtung (Kentung, Burma) area (Saat, 1960: 2219-2222; Saat, 1962: 1-2; Somčhit, 1971: 144). In addition to lacquer, dammar (khi ña) extracted from ngae, pao (Pentacme siamensis), tüng and hiang was utilised as lamp oil and many other purposes; and the astringent juice (namman makmü) of makmü (Parinarium anamese) for waterproofing has long contributed to the traditional

industry of umbrella making, particularly developed in Chiangmai province (Somčhit, 1971: 168; Čharubut, 1973: 704). Also see Tanabe, 1976: 688.

5. The tropical monsoon forest dominated by some deciduous trees including teak or sak (Tectona grandis), dupa (Pterocarpus macrocarpus), püai daeng (Lagerstroemia calyculata) and daeng (Xylia kerrii) are developed not only on the doi but also on the relatively humid soils of lowlands. In many places near villages, however, monsoon forests are replaced by bamboo thickets possibly regarded as secondary vegetation, due to deforestation in search of timber trees such as teak (Ogawa et al., 1961: 69).

6. For detailed descriptions of irrigation systems in these areas, see Chen, 1949: 42; Bunchuai, 1954: Vol.1, 590-593; Tanabe, 1973: 150-151 for Sipsǫng Panna, Scott and Hardiman, 1900/1: 275 for the Shan States, Abadie, 1924; Hickey, 1958: 135 for Thai peoples in the Tonkin Hills, Stuart, 1913 for Upper Burma. Further discussions of traditional systems are given by Harvey Dermaine fa Upper Burma (Demaine, 1978: 60-61) and by the present author for northern Thailand (Tanabe, 1979a).

7. The legal and administrative framework of the government's irrigation policy is discussed in Small, 1972: 11 ff.

8. Peter Kung estimates that these smaller systems cover 0.9 million rai (144,000 ha) (Kung, 1974: 55).

9. An irrigation control group is more formally called samakhom chonprathan rat (people's irrigation association).

10. The physical structure of these weirs is quite similar to the traditional type constructed in Upper Burma (Stuart, 1913: 16-17).

11. For the Mae Faek project, for example, well established social norms for the maintenance of smaller units can be observed (Frutchey, 1969: 145-158). For the case of the Mae Taeng project, see Suwaphot and Vanpen, 1977: 32-46.

12. For further theoretical discussion of relationship between physical

and socio-economic factors involved in irrigation, see Ingersoll, 1969: 7-9; Small, 1974: 679-681; Kaufman, 1971.

13. Few reliable data in published form are available to show the transplanted area by province in the 1970s. However, the annual reports of rice production (baep khao 1, baep khao 2, baep khao 3) in the 1970s summed up at each provincial office shows the overwhelming dominance of transplanting cultivation within the region.

14. The techniques of swidden cultivation in the region are detailed in Judd, 1964 and in van Roy, 1971: 41-48.

15. Detailed discussion and analysis of 'the glutinous rice zone' are provided by Watabe, 1967: 4-12; Watabe, 1976: 96-113; Golomb, 1976: 1-15.

16. Paddy consumption in Northeast Thailand and method of the calculating consumption are discussed in detail by Dixon, 1974: 2-5.

17. In a 1969-70 survey, Fuks and Vingerhoets indicated that the production cost in rice cultivation per rai amounted to 80 baht in Chiangmai province and 107 baht in Ayutthaya province. See Fuks and Vingerhoets, 1972: 77.

18. Hla Myint defines 'minimum subsistence level' thus: "the resources and the technology they possess are just sufficient to keep them alive in their present numbers at the minimum level of subsistence" (Myint, 1973: 33-34). As he recognises, the 'minimum subsistence level' should be distinguished from the concept of 'sbusistence production' which represents an analytic concept in conjunction with 'petty commodity production', as we have discussed earlier. A related discussion in the context of Thailand is touched upon by Luther, 1978: 61-62, particularly in Footnote 19.

19. In many localities of the region the rent of buffalo and the wage for hired labour are normally paid in kind, i.e. unhusked paddy.

20. Among the older generations in the village the necessary khao kepwai kin is often expressed as 30 tang which is equivalent to

45 thang. The Lannathai tang as the old unit of grain capacity is measured by a tang, a cylindrical paddy measure made of teak. The measure has been disappearing since around 1960, being replaced by the Siamese thang containing 20 litres.

21. In 1976 Chiangmai province had the largest number of tenants and part tenants amounting to 54,225 households accounting for 39.4 per cent of the total farm households within the province (Thailand-Agricultural Land Reform Office, 1977: 9).

22. In the North East of Thailand, a form of joint farming practised between parents' and their progeny's households after establishment of the new household is still widely prevalent. Detailed discussion of this relationship is provided by Mizuno, 1968: 848-850; Mizuno, 1971: 127; Demaine, 1977: 252-255.

23. This recent tendency towards little demarcation between kinsmen and non-kinsmen in terms of tenancy is clearly indicated in Turton, 1976: 279.

24. For the discussion of čhap čhọng in the context of Thai peasant customary law, see Yano, 1968: 856-858; Yano, 1967: 808-809. In the historical context, particularly as regards the Chao Phraya delta, Robert Lingat provides a detailed examination. See Lingat, 1940: 50-57.

25. Apart from ricelands, the large-scale reclamation and ownership of orchards in the areas surrounding the Chiangmai basin by capitalist developers who are mostly residents of Bangkok and Chiangmai city has progressed rapidly since around 1970.

26. Historical and sociological accounts on the royal family and provincial governors in Lannathai are examined in detail in Braily, 1969; Braily, 1973: 299-320, 439-469; Calavan, 1974; Paritsana, 1974; Arunrat, 1976.

27. For general discussion of the landlord-tenant relationship under sharecropping, see Griffin, 1979: 22-26; Cheung, 1969.

28. For definition of the category 'rural labourer' or 'agricultural labourer' in the context of contemporary Thailand, see Turton, 1978: 277.

29. Ethnological and historical accounts on miang, fermented tea leaves for chewing, in northern Thailand are given by LeBar, 1967: 105-121; van Roy, 1971: 84-97. For the socio-economic examination of the miang production in relation to the peasants of the region, see van Roy, 1967: 421-432; van Roy, 1971: 97-124.

CHAPTER IV

1. See Thailand-Royal Irrigation Department, 1972: 7. The outline of the Maeklǫng project is provided in Thailand-Maeklǫng Rural Development Project, 1976.

2. Given the total area covered by the Greater Chao Phraya project (7,180,500 rai and the Greater Maeklǫng project (2,518,000 rai) is 9,704,500 rai (1,552,720 ha), the area of the Delta farming region is estimated to be approximately 8 million rai.

3. In Vietnam and Burma, however, long seedlings transplanted after commence of deep flooding are observable (According to a personal communication from Professor Y. Kaida, 1979 and from Dr H. Demaine, 1981).

4. The term nam thuam generally denotes inundated conditions with surface water or nam tha.

5. A series of topographical maps (scale 1:50,000), surveyed mostly in the 1910s and, in some sheets, revised in the 1950s by Division of Maps, Royal Thai Army, provides useful information on the changes of vegetation and land-use.

6. The Siamese word khlǫng, while denoting a canal or khlǫng khut constructed for inland navigation, essentially means a large or small natural tributary or distributary of a river or mae nam. According to Anuman Rajadhon, khlǫng is derived from a Mon word meaning path or way, as in khlǫng lüai (the kerf of a saw) or khlǫng tham (the way of Dharma), and has come to mean a water-course, either natural or man-made, linked to a river (Anuman, 1972: 305).

7. At the present time the rahat is usually driven by small diesel engine and is currently being replaced by power pump (tho sup nam), a more effective and expensive industrial device.

8. In addition to the rahat other miscellaneous water raising implements such as bamboo woven dipper (chong long) and bamboo scooping basket are widely employed for nursery culture and transplanting. See Anuman, 1961: 55; Pendleton, 1962: 140; Thai Khadi Research Institute, 1978: 39, 44.

9. The Ditches and Dikes project started in 1966 and was completed in 1972, covering about 5.6 million rai (0.9 million ha), which accounts for 78 per cent of the total area of the Greater Chao Phraya project (Thailand-Royal Irrigation Department, 1972: 24).

10. The average yield in the project area in 1970 attained 47 thang per rai (2.96 tonne/ha) (Kaida, 1978: 227). This figure is even slightly higher than the average yield (2.8 tonne/ha) in the intermontane basins.

11. For example see the case in Singburi province (Tanabe, 1979b).

12. Owing to the recent growing requirement for water for the early-season cultivation in the main part of the West Bank project area to the south, an immense volume of water must be conveyed from upstream areas overflowing the natural drainage channels in the region. This means that the Retarding Basin must continue to function as a deeply flooded reservoir for the improvement of cultivation in the regions downstream. (According to a personal communication from Professor Y. Kaida, 1979).

13. Further discussion of this point, see Small, 1972: 320.

14. Particularly cultivation of long grain non-glutinous rice, which was sold as Sian Patana, became popular for its higher price in foreign markets. See Suvabhan, 1927: 5.

15. The slightly lower figures for Lopburi and Saraburi provinces is presumably due to cultivation on the marginal fans outside the delta by glutinous rice eating population coming from the North-

east region.

16. Detailed discussion of the development of tenancy in these provinces, see Tanabe, 1978: 58-67.

17. See note 17 of Chapter III. The production cost was estimated at about 300 to 400 baht per rai in Singburi province in 1978 (Tanabe, 1979b: 40).

18. Fuhs and Vingerhoets give 7,342 baht in Ayutthaya and 3,402 baht in Chiangmai province in 1969-70 (Fuhs and Vingerhoets, 1972: 85).

19. In relation to Bang Chan's peasants, Hanks notes as follows: "Not even the most seasoned and successful producer of market rice can anticipate the price for his future crop, calculate his annual income, determine the rate of return on investment, and emerge with a balance sheet of assets and liabilities" (Hanks, 1972: 48).

20. One of the earliest national surveys including the land tenure situation in the post-war period was the Thailand Economic Farm Survey in 1953, which suggests the absence of the tenancy problem, claiming a total of 87.12 per cent owned land (Thailand-Ministry of Agriculture, 1954: 62). However, average figures for regions in this survey fail to show the variations in lower administrative units and cannot demonstrate the much higher rate of tenancy that is to be found in parts of the rice-growing provinces of the delta. Such statistical problems continued in most of the official statistical data subsequently published, until the publication of the National Statistical Office Survey, conducted in 26 provinces of central Thailand in 1967-68, provided land tenure figures by districts (Thailand-Ministry of National Development, 1968).

21. For the rapid growth of maize cultivation in the marginal areas, Uthit provides basic data and analysis in Saraburi province (Uthit, 1962). Also see Silcock, 1970: 117.

22. One of the most popular means of financing was khai fak, a sort of mortgage, by which the vendor has the right to redeem the

property within a contracted period before the buyer acquires title to the land property. Poor smallholders who mortgaged their holdings to landlords or moneylenders in this way for necessary cash quite frequently nevertheless lost their land. Another widespread method of money lending which leads poor peasants eventually to lose their landholdings is called tok khao (literally, hooking rice). The tok khao is a sort of loan by which peasants receive in advance payment for the possible harvest from landlords or moneylenders. It is said that the rate of interest amounted to from 25 to 50 per cent per month in the 1950s (Kamol, 1955: 141). There is another method of repayment of debts, called tok raeng (hooking labour) or tok kin (baiting the hook), in which the borrower must pay in labour. All these methods of mortgage and loan have prevailed widely throughout the delta and probably in other regions to some extent until around 1970. See Kamol, 1955: 141; Kaufman, 1960: 63.

23. For the role of nai kǫng in the Rangsit canal area, see Zimmerman, 1931: 305; Johnston, 1975: 241-244.

24. Full-scale discussion of the landlordism developed in the Rangsit canal area is provided in Johnston, 1975; Sunthari, 1978a; Sunthari, 1978b; Thawisin, 1978.

25. For an historical examination of Lao migrant labourers, see Johnston, 1975: 225 ff.

26. A detailed description of the mobilisation of that labour in the Rangsit canal area at the beginning of this century is given in K.S. 3.2/28. Detailed discussion of Thai institutions of slavery and its dissolution processes can be found in Lingat, 1931; Ishii, 1966; Turton, 1980: 251-292.

27. For an ethnological and historical examination of the origin of na luang among Thai, see Tanabe, 1978: 67-72.

28. The distribution of the na luang subject to the land reform project in various provinces is shown in Krirkkiat, 1977: 276-277; Thailand-Agricultural Land Reform Office, 1979: 3-4.

29. In a village of Ayutthaya province in 1969-70, out of 109 operating households 12 had no ownership title (Amyot, 1976: 89).

30. In the early 1950s, in Bang Chan the fixed rent in kind was 6-10 thang per rai and the fixed rent in cash varied between 40 and 70 baht per rai (Kamol, 1955: 63).

31. Absentee landlords in Bang Chan levied 5 thang per rai, while local landlords 6-8 thang.

32. These trends during the 1950s and 1960s are analysed in detail in Uthit, 1958; Tomosugi, 1969: 284-309.

33. Tomosugi gives an account of the migrant labourers from Angthong province hired in the adjacent Phakhai area of Ayutthaya province where rice varieties with a late maturation time are to be harvested (Tomosugi, 1980: 21-22).

34. For a detailed discussion of tricycle drivers migrated from the North East region into Bangkok, see Textor, 1961.

CHAPTER V

1. An outline of the Mae Taeng irrigation project is provided in Thailand-Royal Irrigation Department, 1972b: 1-9.

2. The traditional New Year's day has been fixed on 13 April since 1889 A.D. (during the fifth reign) in Siam. In Chiangmai and other Lannathai areas it became fixed on the same date probably after the Siamese annexation at the beginning of the century. The description of ceremonies and rituals on the New Year's season is given in Sanguan, 1966: 5-23; Sanguan, 1975: 1-7; Anuman, 1963: 6-176; Anuman, 1952: 13-24.

3. The villagers of the hamlet can consult individually the oracle of phi ban about their own troubles and sufferings.

4. Ideological implications of various spirit cults corresponding to a set of political units are suggested in Turton, 1978: 125-130.

5. The rest mostly consist of Thai Yuan in a wider sense settled by marriage and migration. One Thai Khoen, two Thai Ñọng and one Chinese are also included.

6. Mutual intelligibility among northern Thai groups is pointed out in Moerman, 1965: 1217-1218, 1226.

7. With respect to social organisation, the matrilineal descent group and associated spirit cults, which have often been pointed out in many Thai Yuan communities are also found in Chiangmai village (Turton, 1972: 217-256; Davis, 1973: 53-62; Sanguan, 1969: 84-91). Although slight differences are recognised in kinship terms, there seem few significant differences in material culture, religious and social life as a whole.

8. Until two decades ago, the Chiangmai villagers still had communication with Thai Lü people of Tambon Mae Sap, Amphoe Samoeng, whose ancestors are believed to have been settled at the same time.

9. Although the historical materials hardly mention ethnic groups, it is very likely that captives included Thai Yuan of Chiangsaen region, Thai Ñọng of Hüang Ñọng, Thai Khoen of Chiangtung and Thai Lü of Sipsọng Panna and its adjacent areas.

10. At the time of attack in 1804 A.D., about 23,000 families were captured and the border town Chiangsaen was burnt down to prevent against Burmese re-occupation. These captives were divided into five large groups and sent to Chiangmai, Lampang, Nan, Wiang Čhan (Vientiane, Laos) and Saraburi (Central Thailand) according to King Rama I's suggestion. With respect to migration of captives caused by traditional wars, Prince Damrong suggested the fact that the Thai Lü language of Sipsọng Panna was still found in the Southern Thai dialect spoken around Nakhọn Sithammarat in his introductory note to Chaingrung Chronicle (Damrong, 1966: i-ii).

11. The historical examination of traditional provincial administration and its change in Lannathai is provided in detail in Brailey, 1969; Braily, 1973: 299-320, 439-469; Tej, 1977.

12. In recognition of his distinguished services in the subjugation of local bandits, he was in 1921 granted an honorific title and royal given name, Khun Saisarakit, and a dignity mark or sakdina 400 by the Ministry of Interior.

13. In Amphoe Sena there were 23 rice mills in 1970 and most of the large mills are located along the Čhao Čhet Bang Yihon canal and the Nøi channel (Thailand-Čhangwat Phra Nakhøn Si Ayutthaya, 1970: 16).

14. For rice trading and market practices in Ayutthaya province, see (Pricha, 1971: 11-12).

15. There are regular services by large boat from Tha Thian pier in Bangkok.

16. The raod connecting Ban Phaen with Ayutthaya was constructed as part of the Bang Ban irrigation project (see Figure 18).

17. The S-N drainage may be due to the slight elevation along the Phraya Banlü canal running E-W in the south. See the Sena sheet 47P/EG9 (surveyed in 1916) of the Topographical Map, Division of Maps, Royal Thai Army, 1955.

18. For general discussion of the worship to san phraphuan čhaothi see Anuman, 1953: 3-10; Sombat, 1976: 29-39.

19. The absence of socially structured and formal groups have often been pointed out in many village communities of the delta (Sharp et al., 1953: 26; Phillips, 1963: 105-108; Phillips, 1965: 22; Piker, 1968: 779).

20. Nøk phranakhøn and its administrative and military function within the Ayutthaya Kingdom, see Charnvit, 1976: 97 ff.

21. For the development of water transport between Bangkok, Ban Phaen and Phakhai via the Chao Phraya main channel and the Nøi channel, see Yai, 1943: 1-24.

22. The area of these na luang in 1893 A.D. amounted to 1,508.75 rai in 11 localities, of which 916.75 rai were in the Khanomčhin canal

area (K.S. 3.3/5).

23. Farm rents levied by ordinary landlords were higher, varying between three and ten baht per rai (K.S. 9.2/2).

24. Although children even under 16 years old are often mobilised in hectic periods, their working time tends to be shorter than that of older children and adults.

25. Demand for firewood comes mainly from brick makers located nearby.

26. The strict supervision of the labourers by their supervisors as well as prevailing malaria and the suceptibility to robbery make those labourers unwilling to utilise the cottages provided on miang plantations.

27. In both villages, the 'rich peasant' is often termed khon mi (one who has lots) or khon ruai (wealthy man), while the 'poor peasant' is called yak čhon (the poor) or khon tam tam (one who is lower in status).

28. In his study village in Chiangrai province during the early 1970s, Turton claims that hiring of rural labourers is rather restricted to upper strata of operating households (Turton, 1976: 275, 277). In recent years, however, many tenants have become hired wage labourers even in Chaingmai's subsistence production, as we shall see in Chapter VIII.

29. In a village of Ayutthaya province, Piker points out that the local population declined by about 25 per cent between 1945 and the late 1960s (Piker, 1975: 312).

30. In Chiangmai village 2 part tenants and 3 tenants did not cultivate and 9 landlord-operators out of 22 engaged in only dry land cashcropping of soy-bean and tobacco (also see Table 21).

31. In Chiangmai village the yearly fluctuation of yield varies roughly between 50 and 60 thang per rai (see Table 9).

32. A rotation of upland rice and soy-bean (2 years for upland rice

and 1 year for soy-bean) is commonly observed in the pae.

CHAPTER V

1. A similar layout of weirs can be found in relatively small-scale systems throughout South East and East Asia. See Stuart, 1913: 16 for Burmese examples and Kitamura, 1971: 84-87 for traditional weirs in pre-modern Japan.

2. The twofold structure of a weir can also be observed in some cases along the Mae Ping main channel.

3. The term tae is also used for a small diversion weir. For the terms of irrigation facilities in Lannathai vernacular, see Thammarachanuwat, 1971.

4. For the structure of the spillway in pre-modern irrigation system in Japan, see Kitamura, 1971: 85.

5. A peasant is allowed to install a wooden board in the tertiary canal to hold back water.

6. The provison of the use-rights of water is provided in the People's Irrigation Act, 1939 (B.E. 2482). See Thailand-Phraratchabanyat kan chonprathan rat, 1939: 1294. For the revision of the act in 1976 (B.E. 2519), see Vanpen, 1978: 7.

7. In some localities there are private enterprises of müang fai system as contract irrigation (Turton, 1976: 275; Tanabe, 1979a).

8. The separation of the irrigation control group from the village community is exemplified in Geertz's discussion on Balinese village structure (Geertz, 1959: 995).

9. This is indicated by the fact that most small-scale müang fai systems have a specific name derived from their core village.

10. According to some informants the dry season group was established in the 1950s.

11. This amount of paddy is roughly equivalent to twice the khao kepwai kin (paddy for home consumption) for 2 persons. See Table 9 in Chapter III.

12. The proportional allocation system is described and discussed in detail, for example, in Grader, 1960: 269-272 for Bali; Leach, 1961: 160-172 for Sri Lanka; Coward, 1979: 31 for Luzon; Glick, 1970: 230 for medieval Valencia; and Kitamura, 1971 for pre-modern Japan.

13. A wooden conduit is mainly made of teak log.

14. Examples of farm turnout regulation are provided in Chen, 1949: 42 for Thai Lü in Sipsǫng Panna (Yunnan, China) and Abha and Nisa, 1974: 94 for Sankamphaeng district, Chiangmai province.

15. If one has 3 separated plots of one rai, he is allowed 3 turnouts of the same size.

16. Resistance against new expansion could not occur due to the existence of surplus of water in normal years, so far as the Nǫng Plaman system is concerned. For general discussion, see Hunt and Hunt, 1976: 392.

17. The discussion and accounts of the historical customary laws in relation to criminal offences is provided in detail in Tanabe, 1979a: 10-14; Arunrat, 1977: 315-317; Kraisri, 1965a: 10-14; Kraisri, 1965b: 1-5; Bruneau, 1968: 155-165. For the basic texts of Mangraiwinitchai referring to irrigation customs currently available in published form are Prasert, 1971; Griswold and Prasert, 1977: 137-160.

18. The rate seems to be based on the ongoing wage for one-day labour prevailing in the village and its adjacent area in 1974-75.

19. Discussions are often held between the various mu fai taking water from the same stream during the dry season in an attempt to come to agreement over use of the limited water supplies.

20. Abha and Nisa touch briefly upon this point in the village studied in Sankamphaeng district, Chiangmai province (Abha and Nisa, 1974: 94).

21. A general discussion of proportional responsibility in the South East Asian context is provided in Coward, 1979: 31.

22. 1 lak yai x 600 rai + 2 lak yai x 90 households = 780 lak yai.
40 lak lek x 600 rai = 24,000 lak lek.

23. Traditional almanacs and ritual incantations have traditionally been scribed in pap nang sa (scrolls) or bai lan (palm leaf manuscript), but many versions of them are now available in published form. For example, see Trirat, 1969.

24. The fai spirit (phi fai or phi haksa fai) and its ritual held at the spirit house (hǫ pučha fai) often appear in the traditional customary law texts (Kraisi, 1965a: 12; Prasert, 1971: 97). The description of the fai spirit cult can be found for many localities including Lannathai region and Sipsǫng Panna, Yunnan (Chen, 1949: 42; Bunchuai, 1954: Vol.1, 591; Moerman, 1968: 50; Turton, 1976: 275; Potter, 1976: 99).

25. In old days a living pig used to be killed in front of the spirit house. The sacrificial animal or its substitute are considered to be the most valuable gifts offered to the fai spirit, for which he in return gives protection of the physical system of the mu fai. Such sacrificial offerings have symbolic meaning only in spirit cults, but are never used in most Buddhistic rituals and ceremonies. See Turton, 1972: 255.

26. The general discussion relevant to interpretation of spirit cult, see Beattie, 1964: 207; Groody, 1961: 146; Hobart, 1978: 67.

27. Such mystical function of rituals in Balinese irrigation associations is discussed in Hobart, 1978: 80-81.

28. Prince Damrong gives a brief account suggesting the presence of traditional early season cultivation before the deep flooding season around this swamp at the close of the nineteenth century (Damrong, 1972: 3).

29. If ponded water depth over 5 cm is considered as 'inundated', inundation may last for a period of more than 30 weeks (7 months) (Kaida, 1973: 405).

30. The lǫi krathong festival annually held on a full moon day in November corresponds roughly to the period of nam song.

31. According to personal communication with Y. Takaya and Y. Kaida. Also see Takaya, 1969: 25-26; Takaya 1971: 391-392.

32. The discussion relevant to this point, particularly in the context of Thai history is provided in Wijeyewardene, 1973: 89-110; Ishii, 1978: 18-19, 26; Tanabe, 1975: 70-94.

33. The hae nang maeo and similar rain-making rituals in various localities in Thailand are discussed in Anuman, 1972: 57-68; Anuman, 1954: 39-40. A more general comparison is found in Demaine, 1978: 50-51. In relation to the state involvement in rain-making rituals, it is worth noting that there is an evidently opposing interpretation between King Chulanlongkorn and Chit Phumisak, an eminent figure of Thai Marxism in the 1950s and the early 1960s. See Chulalongkorn, 1971: 543; Čhit, 1974: 257-258.

34. The modern technical term of irrigation and water control in general, which is summed up by chonprathan in official Siamese usage denotes these multifunctional technologies. The definition of 'irrigation', 'water control' and 'chonprathan' in the present study is basically followed by the Royal Irrigation Department of Thailand. See Thailand-Royal Irrigation Department, 1970: 1; Small, 1972: 8.

35. In this period, £1 was approximately equivalent to 17 baht (van der Heide, 1903: 115).

36. F.A.O. Mission for Siam and some official reports of the Ministry of Agriculture well describe the water conditions of the area before completion of the Chainat dam (F.A.O., 1948: 58-59; Thailand-Ministry of Agriculture, 1950: 46-50; Thailand-Ministry of Agriculture, 1957: 146).

37. The recent transformation of cropping pattern chiefly caused by the wide use of low lift pumps as well as by the implementation of water works (Kaida, 1974: 523-524).

38. Despite the aims of overall improvements in water control under the Greater Chao Phraya project since the end of the 1950s, the Retarding Basin region had been regarded as 'dumping places' of excess water drained from the surrounding areas (Kaida, 1973: 405) to retain more favourable water conditions in other areas.

39. Since the canals are fully utilised in daily communication, maintenance of water traffic is one of the main duties of the zone-man.

40. Even though in the sufficiently improved areas, peasants' anti-social behaviour and lack of co-operation often cause damage to field ditches and tertiary canals. Frutchey points out such maintenance problems in her survey of the Sam Chuk project area in Suphanburi province. In the area some peasant operators allow buffaloes to walk and wallow in ditches while other peasants plant rice seedlings in them (Frutchey, 1969: 103, 152).

41. For a discussion of inadequate social practices and the indifference of peasants towards maintenance of irrigation systems in this delta, see Small, 1974: 691-694.

42. Referring to an example in Bang Pahan district, Ayutthaya province, Amyot indicates that the association does not play an important role at the level of individual operating households (Amyot, 1976: 80-81).

CHAPTER VII

1. Technological efficiency does not necessarily mean economic efficiency. For the relevant discussion, see Schultz, 1964: 38-39; Lipton, 1968: 338-342, particularly for the concept of 'survival algorithm'.

2. For a theoretical discussion of the complex technological process in agriculture, see Terray, 1972: 100, 109.

3. Much smaller parcels can be observed in the terraced fields (M1 and M2 fields).

4. In order to neutralise the acid soils, the peasants apply salt- as much as 1 thang per rai every three or four years.

5. Crop failure is surveyed annually in rice production reports prepared by each village and tambon.

6. Only three tenants cultivated off-season rice.

7. According to Fukui's survey in 1972, the new varieties were being adopted not because of their high-yield potentials, but for their short-period, non-photoperiod-sensitive character (Fukui, 1978: 259-262). In Don Chedi (Suphanburi province), one of the first areas in which those varieties were introduced, peasants did not view the modern varieties as higher yielding than the traditional varieties in 1972 (Jerachone et al., 1975: 249-251).

8. The cleared lands could presumably be cultivated under dryland conditions or hai for several years before they transferred completely into transplanted fields.

9. For example, Khana kammakan čhat phim ekkasan thang prawattisat (ed.), 1971: 17; Prachakitkonračhak, 1964: 254 provide the event in detail. A relevant discussion is given in Tanabe, 1979a: 6-9.

10. Medium-term variety is sometimes omitted in peasant classification.

11. Do daeng (literally red early rice) is occasionally classified as a medium-term variety. It may presumably be one of the earliest improved varieties. Ball mentions early attempts to improve varieties in the 1940s and 1950s (Ball, 1951: 15).

12. 13 out of the 112 total operating households sold rice during the 1974-75 cropping season.

13. During the normal pre-harvest months, November and early-December, most peasant households suffer from food shortage and opportunities of wage labour are also restricted.

14. There is no ox-drawn plough and the double buffalo team, which prevails in certain areas of the delta is rarely seen in the

village and adjacent areas. This implies that under the flooded conditions a single buffalo plough is able to provide motive power enough to till the soil.

15. Besides the operating households, it includes 3 rural labourer's households devoted to buffalo husbandry for renting.

16. In normal cases, 30 tang (45 thang) of paddy for a 30 day rental period and 35 tang (52.5 thang) for a 35 day period are paid.

17. 6.4 thang is equivalent to 108.6 baht under the prevalent paddy price of 17 baht per thang in the village (1975). It should be noted that it is considerably higher than the cost of tractor ploughing service in Ayutthaya village, amounting to 30-50 baht per rai in 1975.

18. Buffalo working time in a day is approximately 7 hours lasting 5:00-8:00 am and 2:00-6:00 pm.

19. The depth of ploughing is not very important in wet-rice cultivation. See Grist, 1975: 153.

20. This type of nursery which requires extremely close water control and elaborate care is different from the ordinary wet type prevailing in some localities in the Delta farming region. A detailed analysis of the technical advantage of 'the semi-wet nursery' in relation to soil-surface temperatures of various types of nursery bed is provided in Watabe, 1967: 61-62. In Chiangmai village and adjacent areas, the dry nursery is often observed in the rice fields of Thai Lü peasants, as described in Iwata, 1963: 34; Moerman, 1968: 53-54.

21. Bung is generally plastered with buffalo manure, or khi khwai.

22. The specific gravity of canal water containing silts is higher than that of clean water. It should be noted that seed selection by flotation, which prevails in the Intermontane Basin farming region and elsewhere in South East and East Asian rice-growing areas is absent in Ayutthaya village and most localities in the Chao Phraya delta.

23. The magic pentacle figure is called by differing names such as khaleo (in Ayutthaya village) and chalaeo according to the locality. See Anuman, 1965: 154-155; Tanabe, 1980: 701.

24. This practice of tri ming the tops of the plants widely prevails in many South East Asian countries. Some agronomists suggest that it may reduce evaporation and give rigidity to the plant (Grist, 1975: 155).

25. General accounts on pests are given in Grist, 1975: 335-336.

26. Imports of ammonium phosphate increased rapidly from 1965. The recommended application of ammonium phosphate (16-20-0) by various government agencies is 15 kg per rai (94 kg/ha) (Fukui, 1978: 262).

27. Types of sickle vary greatly in terms of such factors as plant height and conditions of lodging etc. The relevant discussion is provided in Watabe, 1964: 33; Tanabe, 1976: 722-723. Also see Boeles, 1966: 49-51.

28. Those young people are not necessarily from the rural labourer's households, but include those from households of every land tenurial status.

29. For example, see de la Loubere, 1693: 18-19; Xin Yuan Shi: Vol.252, Chronicles, Vol. 149; Kai Hentai, 1690: Vol.17, 1280-1281. For Japanese documents of the seventeenth century dealing with Siam, see Ishii, 1971: 161. Also see Ishii's ecological interpretation of rice-growing in Ayutthaya period (Ishii, 1978: 26-33).

30. Na müang is also called na thung. Many western sources refer to this classification (Bowring, 1857: Vol.1, 201; Child, 1892: 145-146; Smyth, 1898: Vol.2, 278; Carter, 1904: 156; Thompson, 1906: 176-177; Graham, 1924: Vol.2, 8-9). For the traditional classification of riceland and farming techniques, the following works by Thai scholars are essential (Phichitprichakon, 1921: 1-22; Suvaphan, 1927; Wongsanupraphat, 1941: 285-315; Anuman, 1965: 129-194).

31. Until the mid-nineteenth century, the na khu kho with high and constant yield had only spread to the Depression Belts and some parts of the Old Delta Proper, including Ayutthaya, Angthǫng, Lopburi and Suphanburi provinces which were under the relatively effective control of the central government. While the na fang lǫi, which relied mainly on rainfall and inundation, seems to have been distributed in the newly reclaimed areas over the delta. The legal application of the classification had been maintained up to the beginning of this century. See the decrees promulgated in 1864 and 1905 (Prachǫmklao, 1968: 162-168; P.K.P.S. 1951: Vol.20, 163-167). Also see Damrong, 1923: 1-7; Lingat, 1940: 32-33; Čhit, 1974: 253-257.

32. Another term frequently used is na pi (main season rice fields) in opposition to na prang which currently means off-season rice field in general. The na prang, however, seems originally to have indicated the traditional early season cultivation. Graham suggests that such a traditional off-season cultivation, though called na trang, was practised at the beginning of this century (Graham, 1924: Vol.2, 9).

33. Khao lǫi, khao fang lǫi and khao khün nam all mean, in a vague sense, 'floating rice' grown in extremely deep flooding areas (Wongsanupraphat, 1941: 295). However, the former two may include varieties without a floating habit, according to the locality.

34. For a general discussion of 'floating rice', see Ramiah and Ramaswamy, 1941: 1-8; Asanee et al., 1970: 119-133; Small, 1972: 80; Grist, 1975: 80, 110, 140-141.

35. The panicle emerges from the sheath of bai tat hang plathu, which is commonly called in English 'flag leaf' (Grist, 1975: 70; Matsuo, 1961: 149). Also see Anuman, 1965: 154.

36. In 1975, the farm gate price of paddy at Ayutthaya village was 25 baht per thang (2500 baht/kwian) in January and February and 29 baht per thang (2900 baht/kwian) from April onwards.

37. Both methods are widely practised in deltaic environments of South East Asian countries (Grist, 1975: 141-143). These methods are called by differing names according to locality (Tanabe, 1979b: 6). Wongsanupraphat gives a detailed description of these two methods as practised early in this century (Wongsanupraphat, 1941: 294-301).

38. According to the peasant's classification two typical kinds of reed seem to be simple indicators of water condition; kok samriam or kok rangka, a perennial weed can be seen only in the depressions where the level of ground water is high throughout the year, while kok hua daeng or kok klom (Cyperus tegetiformis), an annual weed may emerge anywhere simultaneously with the growing of rice.

39. Some natural drainage channels called lamrang satharana (public water course) are currently preserved as the property of the state. In former times these channels would often function as buffer boundaries between villages. The Rang Khok is such a channel and its depressions containing stagnant water even in the dry season are used for buffalo bathing, and are called aeng khwai or buffalo puddles.

40. Ploughs drawn by two buffaloes are not used in the Tontan field. The typical plough (thai) consists of a rod (khan) and curved handle in which a ploughshare is embedded into an iron coulter. This type of plough is customarily called thai hua mu (pig's head plough), because the ploughshare is designed like a pig's head. It seems to be much influenced by the Indian plough, and is different from the triangular type of plough which is popular in the intermontane basins of northern Thailand (Hopfen 1960: 53-54; Watabe, 1967: 65; Tanabe 1976: 717-718).

41. The power tillers used in the village are divided into two types: rot thai mü, or two-wheeled tiller pushed by hand and the medium-size four wheeled tiller called rot thai nang khap.

42. In Bang Chan a power tiller could plough 5 to 10 rai per day (Hanks, 1972: 126).

43. A detailed description of traditional ploughing is provided in Anuman, 1965: 143-150.

44. For a description of harrowing, see Anuman, 1965: 151; Kamol, 1955: 99.

45. In addition to the samruai and pholoei methods, there is, though within a very limited area, another method called piakniao which is a hybrid of the two. For the piakniao method practised in Singburi province, see Tanabe, 1979b: 6.

46. In Sam Chuk (Suphanburi province) about 25 kg/rai are used (Small, 1972: 103). For example in other countries, 85 kg/ha in Bangladesh and 112 kg/ha in central India and reported (Grist, 1975: 141-142).

47. In other countries the rate of seeding in wetland sowing is normally higher than in dryland sowing; 112 kg/ha in Bangladesh and 150 kg/ha in the Philippines are reported (Grist, 1975: 141-143).

48. The following weeds are commonly observed: seng (genus Corchorus), sano (Sesbania), phak bung (Ipomoea), kok hua daeng (Cyperus tegetiformis) and kok samriam (Cyperus digitatus). Among them phak bung is one of the most popular vegetables for Ayutthaya's diet.

49. In Bang Chan's transplanted field, similar replacement of seedlings was practised (Kamol, 1955: 102).

50. For a general discussion of damage by land crabs, see Grist, 1975: 335-336. Rats (nu na) are another terrible pest prevailing in the Tontan field. The damage caused by rats has been increasing in recent years, though some are caught for food. See Amyot's survey in other parts of Ayutthaya province (Amyot, 1976: 123).

51. For a general discussion of the lodging habit, see Grist, 1975: 160.

52. The deep curved sickle used in the delta is quite different from the Lannathai sickle found in the norther intermontane basins (Watabe, 1964: 37; Tanabe, 1976: 722-723).

53. See Ammar's excellent work for a relevant discussion of the role of middlemen in agriculture marketing (Ammar, 1977: 11-15). A detailed description of rice trading in Ayutthaya province is also given in Amyot, 1976: 159-166.

54. This apparently low rate is caused chiefly by the higher level of farm gate paddy price (25 baht/thang) and relatively good yield (31.57 thang/rai on average) attained in that period. However, the extraction by landlords would be likely to be greater, reaching even 30 to 35 per cent of the gross product, when paddy prices and yields fall.

CHAPTER VIII

1. For a general discussion of peasant socio-economic organisation in relation to labour utilisation, see Béteille, 1974: 26-27. Also see Moerman, 1968: 18.

2. For example, estimated figures of labour requirement in rice cultivation are given for Vietnam and Kampuchea in Dumont, 1954: 138; Delvert, 1961: 347-348. Comparison of labour requirement in various areas are attempted in Hanks, 1972: 167; Ruthenberg, 1976: 190; Calavan, 1977: 91.

3. In the fields of Chiangmai village, for example, we often come across cases in which, while regular farm workers and co-operative workers perform transplanting tasks for more than eight hours, school-age children helping side by side their parents are more enthusiastic for fishing in the plot. The wage labourers hired in harvesting of an Ayutthaya plot on a piece-work basis may work harder and longer than their employer.

4. For a general discussion in relation to intensive labour requirements at specific periods in peasant agriculture, see Marx, 1954: Vol.1, 310-311.

5. Marx identifies 'peasant agriculture' in the historical context as follows: "Peasant agriculture on a small scale, and the

carrying on of independent handicrafts ..... together form the basis of the feudal mode of production, and after the dissolution of that system, continue side by side with the capitalist mode" (Marx, 1954: Vol.1, 316).

6. Theoretical and empirical analyses of co-operative labour in terms of the structural Marxist framework can be found in Meillassoux, 1964; Terray, 1972: 95-186. From a neo-classic position, a similar analytic framework is provided in Firth, 1965: 115-131. However, some structural Marxian attempts reject technological connection in the analysis of co-operative labour. See Freedman, 1975: 167-168; Kahn, 1980: 61-62.

7. To avoid unnecessary theoretical confusion, we have ignored the overall question and debate over 'modes of production'.

8. For detailed discussions on the 'loosely structured social system' thesis, see Evers, 1969; Bunnag, 1971: 1-23; Potter, 1976: 1-11.

9. Putting aside his general thesis, it is particularly interesting that his map clearly shows several geographical clusters of labour exchange within a 'natural community'. See Potter, 1976: 48, map 4.

10. The khǫ raeng is also used in constructing new houses (Kaufman, 1960: 30).

11. Measurement of labour power exchanged on a piece-work basis is rarely found in Chiangmai village, while in Ayutthaya village there is piece-work in harvesting. In Bang Chan it was used together with the man-day basis around 1950 (Sharp et al., 1953: 54).

12. In 1975, a few households paid in cash at the rate of 10 baht for one man-day labour.

13. Potter refers to the sanction of a public scolding against those who don't fulfil the obligations (Potter, 1976: 171).

14. For the case of Bang Chan, see Kamol, 1955: 104. The accounts of the customs in the Delta region during the early part of this

century are given in Graham, 1924: Vol.2, 13-15.

15. However, Potter claims that even, in Bang Chan (a village in the Delta), as in his village studied in the Intermontane Basin region, "reciprocal labour-exchange networks are tightly knit entities that structure the social relations of the families involved" (Potter, 1976: 169).

16. Kaufman says in a delta village that "solicitation of help ..... is first done in the neighbourhood of the rice farm irrespective of family ties" (Kaufman, 1960: 31). In petty commodity production as seen in the Delta farming region, the periphery of bilateral kindred has become increasingly unreliable (Scott, 1976: 27).

17. Further discussion of the fellowship is provided by Turton, 1972: 238 in the Lannathai context and by Kaufman, 1960: 31-32 in the Siamese context.

18. Household No.30 rents out holdings to his children as follows: 10 rai to No.44, 6 rai to No.123 and 2 rai to No.127.

19. The basic discussion of the relationship between senior and junior is found in Kaufman, 1960: 32-36; Potter, 1976: 188-193. The ideological changes of the relationship in recent years are emphasised in Turton, 1976: 282-283.

20. These include 2 landlord-operators, 3 owner-operators, 2 part tenants and 1 tenant.

21. The basic notion of patron-client relationship after erosion of reciprocity is lucidly expressed by Eric Wolf when he says "the two partners to the patron-client contract, however, no longer exchange equivalent goods and services" (Wolf, 1968: 16). Alavi is also critical of reciprocity in the notion of patron and client relationship (Alavi, 1973: 54). However, many scholars dealing with South East Asian peasantries still tend to lay stress only upon reciprocity. For example, see Scott, 1972: 91-113; Scott and Kerkvliet, 1973: 243-244; Wijeyewardene, 1967: 82-83; Hanks, 1972: 86; Hanks, 1966: 55-63.

22. The compulsory relationship institutionalised under the feudal

régime is discussed in detail, though mainly focused on the Siamese kingdom in the delta, in Ishii, 1966; Akin, 1969; Čhit, 1974; Turton, 1980: 251-292.

23. The notion of 'entourage' was initially put forward by Hanks to indicate the patron and client relationship generated in Thai society as a whole (Hanks, 1966: 55-63). Van Roy's study on the miang cultivators in Mae Taeng district (Chiangmai province) strengthened this notion to be applied for the peasantry in the Intermontane Basin farming region (van Roy, 1967: 429; van Roy, 1971).

24. Turton fully demonstrates the exploitative nature involved in co-operative labour and its recent changes (Turton, 1975: 53-57, 73-80).

25. Putting aside the many anthropological studies, even Demaine, who did long-term participant research in the North East, largely fails to detect this crucial aspect involved in co-operative labour (Demaine, 1974: 11-12; Demaine, 1977: 322-334).

26. There are many terms ostensibly indicating egalitarianism and reciprocity. See de Young, 1958: 79; Moerman, 1968: 137.

27. Some Thai scholars give to the term pǫ liang a meaning of mǫ or 'traditional doctor', in addition to 'foster father' and 'wealthy man' (Sanguan, 1973: 118; Met, 1965: 152). For a lexicographical examination, see Wijeyewardene, 1971: 231-233.

28. Token reciprocity between kinsmen in tenancy agreement tends to decline. See note 23 of Chapter III.

29. The term hap čhang more frequently indicates wage labouring outside the village, as in the case of being hired in a miang plantation.

30. Hap čhang ao khao (being hired to take paddy) is also expressed.

31. Although cash-payment is rarely seen in the Mae Rim valley, it has become recently widespread in the central part of the Chiangmai basin.

32. Comprehensive descriptions of labourers' migration and their socio-economic functions in the development of the Delta farming are provided in detail in Johnston, 1975: 225-234; Thawisin, 1978: 132-143.

33. Serious problems of indebtedness among upland-cropping peasants in Sukhothai province were already described even in 1962 (Uthit, 1963).

34. For the role of nai khaek (or nai na khaek) in Anthong province, see Tomosugi, 1980: 21. In Ayutthaya village some rich households send a nai khaek with a hired car to gather labourers for harvesting.

35. These Catholic rural labourers migrated mainly from Chiangrai province and northern districts of Chiangmai province during the past two decades. With their own church roughly built on the eastern pae, they embrace christianity keeping up Catholic ceremonies.

36. The shift from task-oriented to timed labour is, generally speaking, recognised when the employer and employed relationship is established through a purely economic transaction. For the general discussion of the change in the historical context, though mainly focused on England, see Thompson, 1974: 42-44. For basic discussion of time-wages, see Marx, 1954: Vol.1, 508-515.

37. In the uprooting and transplanting tasks of early season cultivation, there are even cases where the employer's household contributes no labour.

38. For a theoretical discussion of landlord's monopsony power over wage labour, see Griffin, 1979: 30-34.

39. However, there is a question of tang, the old unit of grain measurement. See note 20 of Chapter III.

40. According to Marx, the price of labour time to be paid by the capitalist is essentially equal, despite the difference in measurement (Marx, 1954: Vol.1, 517-518).

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A COMPARATIVE STUDY OF RICE CULTIVATION AND AGRICULTURAL TECHNOLOGY IN CHIANGMAI AND AYUTTHAYA

by

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การชลประทานเพื่อการเกษตร ในประวัติศาสตร์เศรษฐกิจไทย

๑. สภาพภูมิประเทศและการชลประทาน

การปลูกข้าวหรือการผลิตข้าวมีความสำคัญที่สุดในเศรษฐกิจของประเทศไทยมาตั้งแต่ศตวรรษที่ ๑๓ จนถึงสมัยปัจจุบันนี้ ในสมัยที่เทคนิคในการเพาะปลูกยังล้าหลังอยู่ การปลูกข้าวอาศัยดินฟ้าอากาศเป็นส่วนใหญ่ กล่าวคือ น้ำฝนและน้ำที่นองท่วมที่ลุ่มริมฝั่งแม่น้ำใหญ่เท่านั้น ซึ่งก็คงจะปลูกข้าวได้น้อยและผลที่ได้รับก็ต่ำ เพราะปริมาณน้ำฝนที่ตกในฤดูฝนมักจะไม่สม่ำเสมอกันทุกปีในภูมิภาคแต่ละแห่งของประเทศไทย ฉะนั้น การปลูกข้าวทำนาจึงต้องอาศัยทั้งน้ำฝนที่ตกลงมาตามธรรมชาติ และทั้งน้ำที่คนทดเข้าในนาตามวิธีการชลประทานด้วย การชลประทานได้มีขึ้นในประเทศไทยมาแต่ไหนแต่ไรแล้ว เพื่อจัดหาน้ำส่งให้แก่การทำนาได้ในจำนวนและตามเวลาที่ต้นข้าวต้องการ

ดังนั้น ถ้าหากจะพิจารณาทางประวัติศาสตร์เศรษฐกิจไทย จำต้องวิจัยสภาพน้ำที่ใช้ปลูกข้าวด้วย เนื่องจากสภาพน้ำในแม่น้ำลำคลองเป็นไปตามลักษณะภูมิประเทศเป็นส่วนใหญ่ ฉะนั้นก่อนอื่นจึงขอแบ่งพื้นที่ที่ใช้ปลูกข้าวตามการวิจัยของ Dr. Takaya โดยเฉพาะที่เกี่ยวกับสภาพน้ำท่าและการชลประทานเป็นอย่างๆ ดังต่อไปนี้* (ดูแผนที่ที่ ๑)

สำหรับบริเวณแม่น้ำปิง วัง ยม น่าน และแม่น้ำเจ้าพระยา ลักษณะของพื้นที่ดินที่ใช้สำหรับการเพาะปลูก แบ่งตามภูมิศาสตร์ธรรมชาติออกเป็น ๕ ประเภทใหญ่ๆ คือ.-

๑. หุบเขาหรือแอ่งระหว่างเขา (Intermountain Basin)
๒. กลุ่มพื้นที่รูปพัด (Fan Complex)
๓. บริเวณลุ่มน้ำใกล้เคียงกัน (Plugged River Channel Area)

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*บทความนี้เสนอต่อที่ประชุมสัมนา คณะเศรษฐศาสตร์ มหาวิทยาลัยธรรมศาสตร์เมื่อวันพฤหัสบดี ที่ ๒๗ มีนาคม ๒๕๑๘

๑) Yoshikazu Takaya, "Phisiography of Rice Land in the Chao Phraya Basin of Thailand." *Tonan Ajia Kenkyu (The Southeast Asian Studies)*, Vol.9, No. 3,(1971) Kyoto, pp. 375-97.

๔. ทุ่งราบลุ่มน้ำเก่า (Old Delta)

๕. ทุ่งราบลุ่มน้ำใหม่ (New Delta)

๑.๑ หุบเขาหรือแอ่งระหว่างเขา (Intermountain Basin)

พื้นที่ประเภทนี้เป็นพื้นที่ที่ใช้ปลูกข้าวทางภาคเหนือทั่วไป เช่น เชียงใหม่ ลำพูน ลำปาง เป็นต้น ภูมิประเทศประเภทนี้ประกอบด้วยลำน้ำพื้นที่รูปพัด และทุ่งราบหุบเขาเล็กๆ ที่มีความลาดชันมากไม่ราบเสมอกัน ชาวนาแถบนั้นทำทำนบกักน้ำไว้ แล้วขุดคลอง เพื่อปล่อยน้ำเข้ามาในนาซึ่งเรียกกันว่า ฝาย (Weir) และเหมือง (Distributary Canal) ซึ่งเป็นวิธีการชลประทานที่ได้กระทำกันมานานแล้ว และยังแพร่หลายอยู่ในปัจจุบันนี้ในแถบนั้น ฉะนั้นจึงเรียกว่า *วิธีการชลประทานแบบเหมืองฝาย*[๒]

๑.๒ กลุ่มพื้นที่รูปพัด (Fan Complex)

ภูมิประเทศประเภทนี้อยู่ระหว่างเขาลงมาตามที่ราบลุ่มแม่น้ำมีพื้นที่แบบพัดอยู่รวมกัน จึงมีความลาดเทกว่าที่ราบลุ่มแม่น้ำ บริเวณนี้ได้แก่ เขตจังหวัดตอนเหนือของภาคกลางลงมาจนถึงจังหวัดนครสวรรค์ และเขตที่ล้อมรอบทุ่งราบลุ่มน้ำภาคกลาง เนื่องจากบริเวณดังกล่าวนี้ ยังมีความลาดชัน จึงมีวิธีการชลประทานเป็นแบบเหมืองฝายด้วย แต่ขนาดมักจะเล็กกว่าเหมืองฝายในบริเวณหุบเขา

๑.๓ บริเวณลุ่มน้ำใกล้เคียงกัน (Plugged River Channel Area)

ในตอนเหนือของภาคกลาง ตั้งแต่อุตรดิตถ์ และสุโขทัย ลงมาจนถึงนครสวรรค์ มีที่ลุ่มน้ำสาขาสำคัญ คือ ปิง วัง ยม น่าน น้ำไหลมารวมกันมากทำให้ท่วมนองอยู่นานทุกปี บริเวณนี้จึงเรียกว่า*บริเวณลุ่มน้ำใกล้เคียงกัน* ในหน้าฝนน้ำไปนองอยู่ ทำให้เกิดหนองบึงมาก บางแห่งในบริเวณนี้ จึงเหมาะแก่การเพาะปลูกอยู่บ้าง

๑.๔ ทุ่งราบลุ่มน้ำเก่า (Old Delta) (ดูแผนที่ ที่ ๒)

บริเวณทุ่งราบลุ่มแม่น้ำเจ้าพระยา (Chao Phraya Delta) ที่เกิดจากการทับถมของตะกอนจากแม่น้ำหลายสาย คือแม่น้ำเจ้าพระยา แม่น้ำท่าจีน แม่น้ำแม่กลอง และแม่น้ำบางปะกง เป็นต้น

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๒) สวัสดิ์ วีระเกษะ *ข้าวเมืองไทย* (พระนคร พ.ศ. ๒๕๑๔) หน้า ๔๓

แบ่งออกเป็นสองบริเวณ คือ *ทุ่งราบลุ่มน้ำเก่า* และ *ทุ่งราบลุ่มน้ำใหม่* บริเวณทุ่งราบตั้งแต่ชัยนาทต่อเนื่องลงมาจนถึงอยุธยา และสุพรรณบุรี จะเห็นว่า เกิดจากการทับถมก่อน จึงเรียกได้ว่าทุ่งราบลุ่มน้ำเก่า ในบริเวณนี้ พื้นที่ฝั่งแม่น้ำลำคลองหลายสาย มีคันกั้นน้ำธรรมชาติ (Natural Levee) ติดต่อกันอยู่ ทำให้มีเนื้อที่ใช้เป็นที่ปลูกสร้างบ้านเรือนได้เป็นทิวแถวไปตามลำน้ำ[๓] ถัดไปก็มีที่ลุ่ม (Backswamp) ข้างหลัง แนวคันกั้นน้ำธรรมชาติเหล่านี้ ได้รับน้ำที่ไหลแยกมาจากแม่น้ำใช้สำหรับปลูกข้าวมานาน ตั้งแต่สมัยกรุงศรีอยุธยาแล้ว

ฉะนั้น เมื่อชาวนาขุดลอกคลองเล็กๆ เชื่อมติดต่อกับห้วยหนอง บึง ในที่ลุ่มก็ทำให้น้ำไหลเข้ามาในเขตนาตามใจชอบได้ วิธีทดน้ำหรือชลประทานแบบนี้ จะเห็นว่าอาศัยลักษณะภูมิประเทศธรรมชาติของบริเวณนี้เอง

๑.๕ ทุ่งราบลุ่มน้ำใหม่ (New Delta)* (ดูแผนที่ ที่ ๒)

ภูมิประเทศประเภทนี้ นับตั้งแต่ อยุธยา เรื่อยลงมาจนถึงชายทะเลอ่าวไทย เป็นพื้นที่ที่ไม่ค่อยมีความลาดชัน เป็นที่ราบลุ่มมากเหมาะในการปลูกข้าว จากการสังเกตทางภูมิศาสตร์ธรรมชาติล่าสุด บริเวณนี้แบ่งออกเป็นอีกสองบริเวณ คือ บริเวณที่ราบลุ่มน้ำใหม่ตอนบน (deltaic high) และบริเวณที่ราบลุ่มน้ำใหม่ตอนล่าง (delta flat) บริเวณที่ราบตอนบนอาจเกิดจากเนินเกาะเก่าที่ทับถมกันหนาอยู่ในอ่าวไทย หรือ แนวคันกั้นน้ำธรรมชาติแถบใกล้ปากแม่น้ำ ยาวต่อกันออกไปทางทิศตะวันออก ทิศตะวันตกและทิศเหนือจากกรุงเทพฯ ซึ่งเป็นศูนย์กลาง ยังมีลักษณะลาดชันและความสูงกว่าที่ราบตอนล่างนิดเดียว ฉะนั้นตอนปลายหน้าฝน จึงมีน้ำแช่ขังอยู่ แต่ระบายออกได้รวดเร็วและสะดวกกว่าที่ราบต่อนล่าง[๔] สำหรับบริเวณที่ราบตอนล่าง ลักษณะภูมิประเทศเป็นที่ราบลุ่มมากที่สุด หน้าฝนบริเวณนี้ ก็มักมีน้ำแช่ขังอยู่ ทำให้เกิดหนอง บึง โดยทั่วๆไป น้ำระบายออกไม่สะดวกเลย[๕] เพราะฉะนั้นถ้าหากสังเกตจากประวัติการอพยพมาในทุ่งราบลุ่มน้ำใหม่ จะเห็นว่า ชาวนามาตั้งถิ่นฐานอาศัยอยู่ในบริเวณที่ราบลุ่มตอนบนก่อน แล้วก็ค่อยๆอพยพมาที่ราบลุ่มตอนล่าง จนถึงในรัชสมัยรัชกาลที่ ๔ และรัชกาลที่ ๕

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๓) Larry Sternstein, "Settlement Patterns in Thailand," *Journal of Tropical Geography*, Vol. 21(1965) Singapore, pp. 30–1.

๔) Takaya, *op.cit.*, pp. 390–1.

๕) *Ibid.*, pp. 387–8.

วิธีการชลประทานที่ใช้ในบริเวณทั้งสองดังกล่าวนี้ เป็นคลองที่ขุดเพื่อส่งน้ำเข้าไปในเนื้อที่ และยิ่งกว่านั้น เพื่อการคมนาคม การค้าขายและการปกครองด้วย ดังนั้น ลักษณะคลองในบริเวณนี้ แสดงให้เห็นถึงจุดประสงค์ทั้งสองอย่าง คือ การคมนาคม และการชลประทาน[๖] ในสมัยต้น ๆ คลองที่ขุดขึ้นมา มีจุดประสงค์ เพื่อการคมนาคมมากกว่า ถึงแม้ว่า บริเวณนี้ จะเหมาะสำหรับการปลูกข้าว แต่ยังไม่มีการขุดคลองเพื่อพัฒนาการปลูกข้าว จนกระทั่งมีความต้องการข้าวเพิ่มขึ้นในระบบเศรษฐกิจในรัชสมัยรัชกาลที่ ๔ และรัชกาลที่ ๕[๗]

ดังกล่าวมาแล้ว สำหรับในเขตแม่น้ำเจ้าพระยา จะเห็นว่ามีการชลประทานเพื่อเกษตรกรรม โดยเฉพาะการปลูกข้าวสองประเภท และวิธีการชลประทานคงเป็นไปตามลักษณะของภูมิประเทศ คือ การชลประทานแบบเหมืองฝาย ซึ่งแพร่หลาย โดยเฉพาะ ในบริเวณหุบเขาทางภาคเหนือ ต่อเนื่องลงมาถึงในบริเวณกลุ่มพันที่รูปพัด และการชลประทานแบบคลอง ซึ่งอาศัยน้ำที่ไหลมาจากแม่น้ำโดยการขุดคลอง และแผ่กระจายออกไปในบริเวณทุ่งราบลุ่มน้ำทั่วไป

๒. การชลประทานแบบเหมืองฝาย

๒.๑ การชลประทานแบบเหมืองฝายในอาณาจักรลานนาไทย

ชาวนาบริเวณหุบเขาทางภาคเหนือ ดำเนินงานชลประทานแบบเหมืองฝายมานานแล้ว โดยชาวนาในสังคมท้องถิ่นรวมกำลังกันสร้างฝายเพื่อรักษาให้ระดับน้ำในแม่น้ำให้สูงขึ้นเพื่อขังน้ำไว้ และขุดเหมืองชักน้ำเข้าในนา[๘] โครงการเหมืองฝายที่สร้างโดยการร่วมแรงกันในสังคมท้องถิ่นอย่างนี้ เป็นที่แพร่หลายในเขตสิบสองปันนาของพวกไทยลื้อในมณฑลยูนนานทางภาคใต้ของประเทศ

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๖) จารุบุตร เรืองสุวรรณ *ภูมิศาสตร์เศรษฐกิจและทรัพยากร* (โรงพิมพ์บำรุงนุกูลกิจ พระนคร พ.ศ. ๒๕๑๙) หน้า ๕๖๙;
พรนิภา พฤฒินารากร และ ทวีศิลป์ สืบวัฒนะ "ข้าวในสมัยปลายอยุธยา พ.ศ. ๒๑๙๙ – ๒๓๑๐," *วารสารธรรมศาสตร์* ปีที่ ๔ เล่มที่ ๓ (ม.ค.–พ.ค. ๒๕๑๘) หน้า ๔๖–๔๗

๗) Sir John Bowring, *The Kingdom and People of Siam* (London, 1857), reprinted 1969, vol. I, p.8.

๘) Willhelm Credner, *Siam, das Land der Tai*, (Stuttgart, 1935), pp. 183–215; The Ministry of Commerce and Communication, *Siam: Nature and Industry*, (Bangkok, 1930), pp. 185–6; Robert L. Pendleton, *Thailand : Aspects of Landscape and Life*, (New York, 1962), p. 145; Takaya, *op. cit.*, pp. 378–9.

จีน[๙] และในเขตบริเวณหุบเขาของพวกไทยต่าง ๆ ในภาคเหนือของแหลมอินโดจีนด้วย[๑๐]

ภูมิประเทศที่สร้างฝ่ายเหล่านี้ ควรจะเลือกที่ลำห้วย ซึ่งน้ำพึงไหลออกมาจากหุบเขา หรือที่ตอนต้นพื้นที่รูปพัด เพื่อช่วยส่งน้ำลงไปตามเหมืองที่ขุดจากฝ่ายเรื่อยลงไปจนถึงเขตนา ตามธรรมดาฝ่ายขนาดเล็กที่ทำขึ้น โดยการร่วมแรงกันนั้น ทำด้วยไม้ไผ่เป็นโครงปิ้กลงไปยังก้นลำห้วย แล้วใช้ไม้พุ่มหินกรวดวางทับถมกันให้แน่นหนา บางแห่งก็ใช้แต่ไม้ไผ่สานเพราะเวลาหน้าฝนน้ำจะไหลพัดพากรวดทรายโคลนตมมาทับถมอยู่ตรงโคนเสาในตาสานของไม้ไผ่[๑๑] พอถึงเวลาระดับน้ำขึ้นสูงสุดฝ่ายเล็กแบบนี้มักจะชำรุดเสียหาย จึงอาจกล่าวได้ว่าลักษณะฝ่ายแบบนี้ใช้ได้ชั่วคราว[๑๒] นอกจากแบบนี้ มีฝ่ายขนาดใหญ่เป็นถาวรวัตถุโดยมากสร้างในแม่น้ำสายใหญ่ ทำด้วยไม้จริง เช่น ไม้สัก ให้แน่นหนายิ่งขึ้น บางฝ่ายก็ทำช่องไว้สำหรับให้เรือแพขึ้นลงได้สะดวก[๑๓] ฝ่ายถาวรแบบนี้ส่งน้ำปริมาณมากได้ เนื่องที่จะอาศัยฝ่ายแบบนี้ก็กว้างขวางยิ่งขึ้น จึงอาจกล่าวได้ว่าเป็นต้นน้ำที่จ่ายน้ำให้เหมืองฝ่ายที่เป็นต้นน้ำจึงมักจะมีระเบียบการแจกจ่ายน้ำที่ประกอบด้วยเหมืองซอยหลายสาย เช่นโครงการปัจจุบันของแม่แฝกและแม่ปิงเก่า เป็นต้น แม้แต่ในสมัยก่อนก็มีระเบียบการบำรุงรักษาต้นน้ำและการแจกจ่ายน้ำอย่างนี้ซึ่งได้ปรากฏหลักฐานว่า คำว่า ทำนบ หรือ ฝาย ภาษาพายัพมีหลายคำต่างกันตามลำดับขนาด คือฝาย คือทำนบใหญ่ แต่ คือทำนบที่แยกจากฝายเข้าเหมือง

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๙) สำหรับตัวอย่างการร่วมแรงกันในหมู่หรือคณะของพวกไทยลื้อ เป็นที่น่าสังเกตว่า การร่วมแรงกันอย่างนี้ก็ยังมีในสังคมท้องถิ่นของไทยลื้อในเขตจังหวัดเชียงราย ดู บุญช่วย ศรีสวัสดิ์ *ไทยสิบสองปันนา* เล่ม ๑ (คลังวิทยา พ.ศ. ๒๔๙๘) หน้า ๕๙๐–๓

Chen Han–seng, *Frontier Land System in Southernmost China*, (New York, 1949), pp. 34, 41–42; Michael Moerman, *Agricultural Change and Peasant Choice in a Thai Village*, (University of California Press, 1968), pp. 50–53; Shigenaru Tanabe, "On the Administrative Form of Lu in Sip Song Pann, Yunnan: Around the Political Organization and the Land System," (in Japanese). *Kikan Jinruigaku* (Quarterly Journal of Anthropology), Vol. 4, No. 1, (Kyoto, 1973), pp. 150–1.

๑๐) เช่นพวกไทยใหญ่อยู่ในประเทศพม่า พวกโทและไทยคำอยู่ในประเทศเวียตนามเหนือ ดู James George Scott and J.P. Hardiman, *Gazetteer of Upper Burma and the Shan States, Pt.1*, Vol. 1, (Rangoon, 1900/1), p. 275; Maurice Abadie, *Le races du Haut–Tonkin de Phong–Tho a Lang Son*, (Paris, 1924,) p. 41; Le Bar et. al. *Ethnic Groups of Mainland Southeast Asia*, (New Haven,1964), p. 220.

๑๑) สวัสดิ์ วีระเกษะ *เล่มที่อ้างแล้ว* หน้า ๙๓

๑๒) Walter Armstrong Graham, *Siam*, Vol. 2, (London, 1924) pp. 33–4.

๑๓) ไกรศรี นิมมานเหมินท์ "กฎหมายชลประทานของพ่อขุนเม็งราย" *สังคมศาสตร์ปริทัศน์* ปีที่ ๓ เล่ม ๒ พ.ศ. ๒๕๐๘ หน้า ๑๒

เล็ก (ซอย) และ ต๊าง คือทำนบเล็กที่แยกน้ำจากแต่ไปสู่ที่นา หรือสวน[๑๔] ซึ่งกล่าวไว้ในมาตราหนึ่งของมังรายศาสตร์ด้วย[๑๕]

การชลประทานแบบเหมืองฝาย ซึ่งเป็นระเบียบการบำรุงรักษาต้นน้ำและการแจกจ่ายน้ำดำเนินงานมาอย่างไรนั้น ตำนานในพงสาวดารโยนก ซึ่งเรียบเรียงโดยพระยาประชากิจกรจักร์ (แช่ม บุนนาค) ใน พ.ศ. ๒๔๖๐ กล่าวถึง การทำฝายและการขุดเหมืองที่เมืองเชียงแสนเก่าว่า *"ครั้นพระพุทธศาสนกาลล่วงได้ ๑๖๒ พรรษา พระองค์เชือง...แล้วให้ขุดเหมืองใหญ่ต่อน้ำแม่สายทดน้ำขึ้นเลี้ยงนาแคว้นซ้ายให้ราษฎรได้ทำนาโดยสะดวก"*[๑๖] สำหรับเรื่องนี้มีกล่าวในตำนานชื่อ *สิงหนวัติ* อีกด้วย ถึงแม้ว่าเรื่องนี้จะเป็นแต่เพียงนิทานปรัมปรา แต่ก็ให้ข้อคิดเห็นว่า คงมีการชลประทานแบบนี้ที่หุบเขาเมืองเชียงแสน ต่อมาจนถึงสมัยพ่อขุนมังรายมหาราชจะเข้าตีอาณาจักรหริภุญไชย เมืองลำพูน ได้ปรากฏหลักฐานว่า ขุนฟ้าอำมาตย์คนหนึ่ง ซึ่งรับอาสาพ่อขุนมังรายไปตีเมืองหริภุญไชยนั้น ได้เกณฑ์แรงราษฎรให้ขุดเหมืองขนาดใหญ่ในปี จ.ศ. ๖๔๒, ค.ศ. ๑๒๗๐ (พ.ศ. ๑๘๑๓) ก่อนที่จะลงมือสร้างเหมืองนั้น เขากล่าวว่าคงจะมีนาที่อาศัยเหมืองฝายมาแต่ไหนแต่ไรแล้ว แล้วก็เสนอโครงการเหมืองแบบใหญ่อีกดังนี้ *"ข้าเจ้าได้เลียบดูบ้านเมืองเจ้าเหนือหัวทุกแห่งทุกพันไร่พันนา ข้าวกล้าดีบ่ดีใคร่รู้ว่าอัน ข้าเห็นพันนาทวนกับราคาลุ่มเมืองฝายบ่ดี ข้าวตายแดดมากนัก ดังข้าจักขุดลอมน้ำอันหนึ่งเหนือฟากแม่พิงค์กล่าวันออก ให้เป็นแม่น้ำแผ่วออกมาถึงพันนา เชียงเรือมาต่อแม่น้ำกวง ให้ชาวบ้านชาวเมืองได้แปลงฝายเอาน้ำเข้านา"*[๑๘] คำว่า "ฝาย" คำสุดท้ายอาจหมายถึงฝายเล็ก ๆ หรือแต หรือต๊าง ที่ชาวนาสร้างขักน้ำในเหมืองใหญ่เข้าหล่อเลี้ยงนา ซึ่งเป็นการแจกจ่ายน้ำที่ชาวบ้านชานเมืองบำรุงรักษาเอง

ข้อความต่อไป กล่าวว่า *"ครั้นถึงเมื่อฤดูร้อนยามแล้ง ขุนฟ้าก็บ่าวร้องชาวเมืองทั้งหลายมาขุดคลองให้เป็นเหมืองไปต่อน้ำแม่พิงค์เหนือสบแม่แตง (ปากน้ำแตง) ฝาย*

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๑๔) พระธรรมราชานุวัตร *หลักภาษาไทยพายัพ* (เชียงใหม่ พ.ศ. ๒๔๑๕)

๑๕) ดร. ประเสริฐ ณ นคร (แปล) *มังรายศาสตร์* (พิมพ์แจกงานศพนายหลวงโหรกิตยานุพัทธ์) พ.ศ. ๒๕๑๔) หน้า ๑๐๑

๑๖) พระยาประชากิจกรจักร์ (แช่ม บุนนาค) *พงสาวดารโยนก ฉบับหอสมุดแห่งชาติ* (คลังวิทยา พระนคร พ.ศ. ๒๕๑๖) หน้า ๑๔๔

๑๗) Camille Notton, *Annales du Siem*, Premiere partie, (Paris, 1926), p. 157; "ตำนานสิงหลวัติกุมาร" *พงสาวดารเมืองเงินยางเชียงแสน* ประชุมพงสาวดาร เล่ม ๒๓ (องค์การค้าคุรุสภา พ.ศ. ๒๕๑๒) หน้า ๑๓

๑๘) *พงสาวดารโยนก* เล่มที่อ้างแล้ว หน้า ๒๔๔

ตะวันออกล่องมา ระยะยาวได้ ๑๗,๐๐๐ วา คนทั้งหลายมาขุดเหมืองอันนั้นเป็นอันร้อน ไหม้ลำบากนักพากันอิดคราง ขุนพ่ำก็ว่าบ่เป็นแต่กูนา พระยาเจ้าหากให้ขุดดาย สูอย่าคราง ขุนพ่ำจำให้ขุดต่อสิ้นฤดูร้อนสี่เดือนก็แล้ว คนทั้งหลายครางว่าเราขุดเหมืองปางนี้แข็งนักแลว่า อันลวดได้ชื่อ (เลยได้ชื่อ) ว่าเหมืองแข็ง ภายหลังมาถึงแผ่นดินเจ้าติโลกราช[๑๙] จึงเปลี่ยนชื่อเป็นเหมืองแก้วมาต่อเท่าบัดนี้แล"[๒๐]

เกี่ยวกับที่เหมืองสายน้ำ บางท่านอ้างว่าเป็นเหมืองแก้ว หรือเหมืองวังลาว ซึ่งปัจจุบันอยู่ในเขตอำเภอแม่ริม จังหวัดเชียงใหม่[๒๑] แต่บางท่านอ้างว่าเป็นเหมืองร้างอยู่เหนือฝายแม่แฝกไปเล็กน้อย และเหมืองเดิมนั้นขนานกับลำเหมืองแม่แฝก แต่สูงกว่าลำเหมืองแม่แฝกปัจจุบัน[๒๒]

อย่างไรก็ตาม โครงการเหมืองฝายน้ำคงจะใหญ่มหึมา และชักน้ำเข้าหล่อเลี้ยงนาได้เป็นบริเวณกว้างขวาง ถ้าหากเหมืองเดิมนั้นมีขนาดพอ ๆ กับเหมืองแม่แฝกปัจจุบันจะเลี้ยงที่นาได้ถึง ๗๐,๐๐๐ ไร่[๒๓] ดังนั้น อาจกล่าวได้ว่า การสร้างเหมืองฝายแบบใหญ่อย่างนี้เป็นงานสาธารณะ หรืองานราชการที่พระมหากษัตริย์สั่งให้สร้างโดยการเกณฑ์แรงราษฎร ในสมัยอาณาจักรลานนาไทย จะเห็นว่าเป็นภารกิจสำคัญเพื่อรักษาจำนวนไพร่ ซึ่งถูกเกณฑ์แรงสำหรับดำเนินราชการ ดังนั้น ในสมัยนั้นการสร้างเหมืองฝายเพื่อการผลิตจึงมีลักษณะสำคัญพอ ๆ กับการสร้างสถานที่เกี่ยวกับการทหาร เพราะเป็นโครงสร้างเศรษฐกิจสำคัญอย่างยิ่ง ฉะนั้น ไม่ว่าจะเป็นกษัตริย์ที่ปกครองเชียงใหม่ หรือเจ้าเมืองที่ปกครองหัวเมือง ย่อมได้เคยพยายามบำรุงรักษาการชลประทานแบบใหญ่มาแล้ว สำหรับหุบเขาเมืองน่าน จากพงศาวดารเมืองน่าน ฉบับพระเจ้าสุริยพงษ์พริตเดช ปรากฏหลักฐานว่าเจ้าเมืองน่านอุตส่าห์ปรับปรุงการเหมืองฝาย เพื่อรักษาโครงการผลิตข้าวของชาวนา ตั้งแต่ จ.ศ. ๑๐๖๙ (พ.ศ. ๒๒๕๐)[๒๔] ภายหลังต่อมาถึง จ.ศ. ๑๑๖๑ ค.ศ. ๑๗๙๙ (พ.ศ. ๒๓๔๒) สภาพการสร้างโครงการเกณฑ์แรงไพร่ปรากฏออกมาอย่างชัดเจนดังต่อไปนี้. "*เถิงจุลศักราช ๑๑๖๑ ตัว ปี*

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๑๙) อาจเป็นพระเจ้าก็อนา รัชกาลที่ ๙ แห่งราชวงศ์มังราย กู ไกรศรี นิมมานเหมินท์ *เล่มที่อ้างแล้ว* หน้า ๑๑

๒๐) *พงศาวดารโยนก* เล่มที่อ้างแล้ว หน้า ๒๕๔

๒๑) ไกรศรี นิมมานเหมินท์ *เล่มที่อ้างแล้ว* หน้า ๑๑

๒๒) แผนกโครงการชลประทานพายัพ จังหวัดเชียงใหม่ *รายงานการสร้างโครงการ เหมืองผาแตก จังหวัดเชียงใหม่* (กรมชลประทาน พ.ศ. ๒๔๙๒) หน้า ๑

๒๓) Royal Irrigation Department *Tables Showing Water Resources Development in Thailand*, completed to the end of 1971 and under construction in 1972, (Bangkok, 1972) p. 1.

๒๔) แสนหลวงราชสมภาร "เรื่องราชวงศ์ปกรณ์ พงศาวดารเมืองน่าน", *ประชุมพงศาวดารภาคที่ ๑๐* เล่ม ๕ (องค์การค้าคุรุสภา พ.ศ. ๒๕๐๗) หน้า ๓๓๒–๓ และเล่ม ๑๐ หน้า ๒๙–๓๐

กัดเม็ด เดือน ๖ ลง ๒ ค่ำ ท่าน (เจ้าอัตถวรบัญโญ) ก็ขับเอาเจ้านายท้าวขุนไพร่ไทยได้กำลัง ๔๙๖๓ คน นอกนี้ มีเจ้านายขุน ๔๓๔ คน รวมด้วยกันมีคน ๕๓๙๗ คน ก็ยกเข้าไปสร้างฝายสมุน วัน เดือน ๖ ลง ๕ ค่ำ ก่อแรกลงหลักไว้ก่อนแล้ว จึงขุดเหมืองขึ้นต่ำ ๓๑๒ คน รวมต่ำ..... รวมต่ำเหมือง ๒๐๘๑ ต่ำเกิงหั้นแล ดังนั้นฝายสมุนที่นั้นอันห่างสูญ แต่เมื่อลาวก้อน ก้อมเข้ามากวาดเอาเมืองน่านหนีนั้น ก็เป็นอันนานนักแล นานได้ ๒๑๙ ปี เจ้าหลวงอัตถวรบัญโญ ท่านก็มาสร้างตั้งแต่วันก่อนแรกลงดับฝายนั้นมาได้ ๑๕ วัน ก็ลุแล้วบริบวรณ์ วันนั้นมั่นคงดีเป็นหุ่งเป็นนามาตราบเถิงบัดนี้แล ฯ"[๒๕]

คำว่า ต่ำเหมือง อาจหมายความว่า ร่วนเหมือง แต่ความหมายคำนี้ยังไม่ปรากฏแน่นอน อย่างไรก็ตาม เจ้าเมืองน่าน เกณฑ์แรงไพร่ไทยเป็นจำนวนมาก ยิ่งกว่านั้น เจ้านายท้าวขุนหลายคนเข้าร่วมด้วย ฝายสมุนนี้เป็นฝายสำคัญเลยงนาอยู่ใกล้ ๆ ชานเมืองน่าน สร้างขึ้นไว้ในแม่น้ำสมุน สาขาของแม่น้ำน่าน ฉะนั้น ตั้งแต่นั้นมาได้มีการซ่อมแซมเหมืองฝายนี้อยู่เสมอ[๒๖] ภายหลัง ถึงสมัยรัชกาลที่ ๕ นักภูมิศาสตร์ McCarthy ได้บันทึกไว้ว่าในแถบนี้ บำรุงรักษาระเบียบการชลประทานอย่างดียิ่ง จึงมีนาที่ปลูกข้าวงอกงามกว้างขวาง[๒๗]

๒.๒ การชลประทานแบบเหมืองฝายในอาณาจักรสุโขทัย

นอกจากตัวอย่างในหุบเขาภาคเหนือ การชลประทานแบบเหมืองฝายก็ยังมีในบริเวณกลุ่มพื้นที่รูปพัดอยู่ในเขตจังหวัดตอนเหนือของภาคกลางด้วย ซึ่งเป็นอาณาเขตกรุงสุโขทัย เป็นสมัยเดียวกับยุคลานนาไทย หลักฐานจากศิลาจารึกกรุงสุโขทัยนั้น ก็กล่าวถึงโครงการชลประทานแบบนี้ในศิลาจารึกกรุงสุโขทัยหลักที่ ๓ ศิลาจารึกนครชุม เมื่อ พ.ศ. ๑๙๐๐ (ค.ศ. ๑๓๕๗) ในรัชกาลพญาลิไทย คือ พระธรรมราชาที่ ๑ มีคำว่า *"เหมืองแปลงฝายรู้ปรา....."*[๒๘] ต่อมาเมื่อถึงสมัยที่อาณาจักรกรุงศรีอยุธยารวมกันกับอาณาเขตกรุงสุโขทัยแล้ว จึงมีหลักฐานจากศิลาจารึก

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๒๕) *เล่มเดิม* เล่ม ๑๐ หน้า ๓๔

๒๖) ในปี จ.ศ. ๑๑๗๖ (พ.ศ. ๒๓๕๗) ยกเอากำลังคน ๑๐,๐๐๐ คนไปขุดเหมืองหลวงและตั้งฝายสมุนนี้ และในปี จ.ศ. ๑๑๘๒ (พ.ศ. ๒๓๖๓) ก็เกณฑ์กำลัง ๑,๐๐๐ คนอีกด้วย ดู *เล่มเดิม* เล่ม ๑๐ หน้า ๔๙–๕๐, ๕๗

๒๗) Smyth และ McCarthy สังเกตการชลประทานเมืองน้ำ ดู James McCarthy, *Surveying and Exploring in Siam* (London, 1900), p. 80; H. Warington Smyth, *Notes of a Journey on the Upper Mekong, Siam*, (London, 1900), p. 18.

๒๘) แผนกโบราณคดีกรมศิลปากร *ประชุมศิลาจารึกสยาม ภาคที่ ๑* (พระนคร ๒๔๖๗) หน้า ๘๐

บนฐานรูปปั้นพระอิศวรเมืองกำแพงเพชร ในปี จ.ศ. ๑๔๓๒ (พ.ศ. ๒๐๕๓) ว่า *"อนึ่งพ่อขุนผาเมืองทำเอาน้ำไปเถิงบางพานนั้น ก็ถมหายสิ้น และเขาย่อน วานาหางพ้า และหาห่อนั้นพบ กระทำห่อเอาน้ำเข้าไปเลี้ยงนาให้เป็นนาเหมืองนาฝายมิได้เป็นหางพ้ากัน"*[๒๙]

ดังนั้น ตั้งแต่ในสมัยขุนผาเมือง ซึ่งอาจเป็นพระราชวงศ์กรุงสุโขทัย คงมีการชลประทานแบบนี้ ในเขตเมืองกำแพงเพชร แต่เห็นว่า การทำเหมืองฝายเหล่านี้ คงขนาดเล็กกว่าเหมืองฝายแบบใหญ่ในบริเวณหุบเขา ซึ่งสร้างในแม่น้ำใหญ่มากกว่า เป็นงานสาธารณะหรืองานราชการ เพราะเนื่องที่น้ำรวมกันของแม่น้ำในบริเวณนี้เล็กกว่าในบริเวณหุบเขา ฉะนั้น แม้ว่าจะมีการชลประทานเป็นงานราชการ ขนาดนั้นก็อาจเล็ก จึงเห็นได้ว่า ตั้งแต่สมัยสุโขทัยเป็นต้นมา นอกจากการทำนาในบริเวณพื้นที่รูปพัดแล้ว พื้นที่ปลูกข้าวอาจต่อกันออกไปถึงบริเวณลุ่มน้ำใกล้เคียงกัน โดยอาศัยน้ำที่ท่วมเข้ามาได้

สำหรับเขตเมืองสุโขทัยเก่า ศิลาจารึกพ่อขุนรามคำแหง กล่าวถึงว่ามี "ทะเลหลวง" เบื้องตะวันตก และก็มี "สรีดภงส" ทิศใต้[๓๐] "สรีดภงส" นี้คงจะเป็นอ่างเก็บน้ำ ซึ่งปัจจุบันนี้ กรมศิลปากรได้ซ่อมแซมให้คงสภาพเดิมไว้ บางท่านอ้างว่า อาจจะเป็นอ่างเก็บน้ำสำหรับการชลประทานเพื่อกักน้ำไว้ทำนาเวลาหน้าแล้งก็ได้[๓๑] แต่ตอนนี้ยังไม่มีหลักฐานว่า "สรีดภงส" นี้ใช้ประโยชน์ทางการเกษตร หรือใช้สำหรับกินดื่มในเมือง เมื่อถึงหน้าแล้ง เกี่ยวกับคำว่า "ทะเลหลวง" พระบาทสมเด็จพระมงกุฎเกล้าเจ้าอยู่หัวได้ทรงสันนิษฐานว่าอาจจะเป็นพื้นที่ตำบลทุ่งหลวง ซึ่งอยู่ในระหว่างเมืองสุโขทัยเก่าและเมืองใหม่ หมายถึงที่กว้างมีน้ำขังเป็นฤดู ๆ[๓๒] ซึ่งตรงกับพื้นที่ในบริเวณลุ่มน้ำใกล้เคียงกันกับที่ผู้เขียนได้กล่าวมาแล้ว แต่เกี่ยวกับเรื่องนี้ ยังมีคำอธิบายความเพิ่มเติมของกรมพระยาดำรงราชานุภาพว่า "ทะเลหลวง" นี้อาจจะหมายถึง รอยสระโตใหญ่ มีสัณฐานเป็นรูปสี่เหลี่ยมรีเหมือนอย่าง "สระสรง" ที่นครธมเมืองเขมร หรือมิฉะนั้น ก็เมื่อสมัยสุโขทัย ที่ลุ่มทางด้านคงยังเป็นบึงใหญ่ เรียกกันว่าทะเลหลวงก็เป็นได้[๓๓]

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๒๙) *เล่มเดิม* หน้า ๑๕๘

๓๐) *เล่มเดิม* หน้า ๕๕–๕๖ สรีดภงส Skt Saridbanga

๓๑) พรนิภา พฤฒินารากร และ ทวีศิลป์ สืบวัฒนะ *เล่มที่อ้างแล้ว* หน้า ๔๗

๓๒) พระบาทสมเด็จพระมงกุฎเกล้าเจ้าอยู่หัว "เที่ยวเมืองพระร่วง" *เรื่องพระร่วงเที่ยวเมืองพระร่วง ฯ ฉบับหอสมุดแห่งชาติ* (กรมศิลปากร พระนคร พ.ศ. ๒๕๐๔) หน้า ๑๓๖

๓๓) *เล่มเดิม* หน้า ๑๓๗

ถึงแม้ว่า "ทะเลหลวง" จะอยู่ตรงรอยสระโตใหญ่ หรืออ่างเก็บน้ำโบราณ ทางทิศตะวันออกเฉียงเหนือติดต่อกับวัดพระพายหลวง ซึ่งคิดว่า เป็นตัวเมืองเดิมเมื่อครั้งพวกเขมรปกครอง[๓๔] เดี๋ยวนี้ ก็ยังไม่มีหลักฐานว่า สระหรืออ่างเก็บน้ำนั้นใช้ในการปลูกข้าว ทำให้สามารถทำนาบริบูรณ์ดีหรือไม่ ยังไม่ปรากฏแน่ชัดว่า มีระเบียบการแจกจ่ายน้ำเข้าในเขตนา คงมีแต่นครธมเมืองเขมร[๓๕]

อย่างไรก็ตาม สำหรับเมืองสุโขทัยเก่า ยังไม่แน่ว่า สถานที่ทั้งสองที่กล่าวมาแล้วมีจุดประสงค์อย่างไร แต่อาจกล่าวได้ว่า ในอาณาเขตกรุงสุโขทัย ซึ่งแผ่ออกไปในบริเวณกลุ่มพื้นที่รูปพัด และบริเวณลุ่มน้ำใกล้เคียงกันเป็นส่วนใหญ่นั้น วิธีการชลประทานแบบเหมืองฝายขนาดเล็กก็แพร่หลายทั่วไป ยิ่งกว่านั้นก็อาจมีการทำนาโดยอาศัยน้ำท่วมในบริเวณลุ่มน้ำใกล้เคียงกับริมแม่น้ำปิง วัง ยม น่าน อีกด้วย

๒.๓ การชลประทานแบบเหมืองฝายกับสังคมเศรษฐกิจ

ดังกล่าวมาแล้ว ระเบียบการชลประทานแบบเหมืองฝายประกอบด้วยทั้งต้นน้ำและทั้งการแจกจ่ายน้ำด้วย ในสมัยอาณาจักรล้านนาไทย พระมหากษัตริย์ หรือเจ้าเมืองมักจะสร้างเหมืองฝายแบบใหญ่ ให้เป็นต้นน้ำ เพื่อการผลิตของชาวนาให้เจริญขึ้น แต่จะเห็นว่าการแจกจ่ายน้ำ ซึ่งอาศัยต้นน้ำ และการเหมืองฝายขนาดเล็กมีการบำรุงรักษาอยู่ในแต่สังคมท้องถิ่นเท่านั้น จาก *"มังรายศาสตร์"* ได้ปรากฏหลักฐานว่า พระมหากษัตริย์ทรงปล่อยให้สังคมท้องถิ่น ทำการเหมืองฝายกันเอง *"มาตราให้ไพร่มีเวรผลัดเปลี่ยนกัน"* ใน *"มังรายศาสตร์"* กำหนดไว้ดังต่อไปนี้ว่า *"มาตรา ๑ ควรจัดให้ไพร่มีเวรผลัดกัน มาทำงานหลวง ๑๐ วัน กลับไปสร้างเหมืองฝาย ไร่นาสวนเรือกที่ดิน ๑๐ วัน จัดเช่นนี้ ถูกตามทำนองคลองธรรมแต่โบราณนั้น"*[๓๖]

ดังนั้น การทำงานหลวงคงจะรวมทั้งการสร้างซ่อมแซมเหมืองฝายแบบใหญ่ด้วย โดยการเกณฑ์แรงไพร่ นอกจากนี้ เข้าใจว่ามีการสร้างเหมืองฝายขนาดเล็กในสังคมท้องถิ่นด้วย ฉะนั้น

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๓๔) *เล่มเดิม* หน้า ๑๖๑

๓๕) B.P. Groslier, *Angkor et la Cambodge au XVIe siecle*, (Paris, 1958), pp. 108–112.

๓๖) ขณะนี้มังรายศาสตร์มี ๔ ฉบับอยู่ในเมืองไทย คือฉบับวัดเสาไห้ ฉบับนายไกรศรี นิมมานเหมินท์ ซึ่งคัดจากต้นฉบับของกงสุลฝรั่งเศส นายน็อดดอง ฉบับวัดเชียงหมั้น และฉบับมหาวิทยาลัยเชียงใหม่ ในบทความนี้ผู้เขียนใช้ตามฉบับ ดร. ประเสริฐ ณ นคร ซึ่งเป็นฉบับเรียบเรียงเป็นภาษาปัจจุบันจากฉบับวัดเสาไห้ และตามบทความของนายไกรศรี ซึ่งใช้ฉบับนายไกรศรีเป็นหลัก *มังรายศาสตร์* เล่มที่อ้างแล้ว หน้า ๕

รัฐบาลของพระมหากษัตริย์จึงต้องมีข้อบังคับเกี่ยวกับการบำรุงรักษาเหมืองฝายในสังคมท้องถิ่นไว้เพื่อควบคุมระเบียบการชลประทานอย่างดียิ่ง ข้อบังคับเรื่องนี้ กำหนดไว้ใน *"มังรายศาสตร์"* อย่างละเอียดลออ ในข้อบังคับเหล่านี้ โดยเฉพาะการร่วมแรงกันในสังคมท้องถิ่นมีความสำคัญมาก ต้องห้ามมิให้ชาวบ้านหนีไปเสีย ต้องไปทำงานร่วมแรงกันทำเหมืองฝาย ฉะนั้น ถ้าหากใครไม่ยอมไปทำงาน แต่แอบไปลักน้ำ รับประโยชน์จากเหมืองฝาย ซึ่งเป็นผลจากการร่วมแรงกัน จะถูกลงโทษตั้งแต่โทษเบาไปจนถึงประหารชีวิต ความผิดต่อการทำงานร่วมแรงกัน ส่วนมากเป็นการลักขโมยน้ำจากเหมืองฝาย และการทำเหมืองฝายเสียหาย[๓๗]

สิ่งสำคัญอีกอย่างหนึ่งก็คือ การทะเลาะวิวาทกัน เกี่ยวกับการทำนา การชลประทานและการแจกจ่ายน้ำจากเหมืองฝาย[๓๘] การทะเลาะวิวาทกันนี้มักจะเกิดจากระบบการชลประทานเอง คือ อาจจะมีระเบียบการแจกจ่ายน้ำอย่างซับซ้อนละเอียดถี่ถ้วน ฉะนั้น ถ้าหากรัฐบาล หรือผู้ปกครองท้องถิ่นจะควบคุมระเบียบการผลิตของชาวนาโดยตรง จึงต้องมีข้อบังคับเกี่ยวกับการแจกจ่ายน้ำอย่างมีระเบียบแบบแผน แต่ถึงแม้จะมีข้อบังคับสำหรับไกล่เกลี่ยการทะเลาะวิวาทกัน ซึ่งเกิดจากการขโมยน้ำ หรือ การขุดทำลายแต เป็นต้น ก็ไม่มีข้อความพิสดารสำหรับวิธีการแจกจ่ายน้ำอย่างละเอียด เพียงแต่กำหนดไว้ว่า เจ้าขุนผู้อาจเป็นข้าราชการชั้นต่ำ มีหน้าที่แบ่งน้ำเท่านั้น ตามบทความของนายไกรศรี นิมมานเหมินทร์ ดังต่อไปนี้

> *"ห้อเจ้าขุนเร่งปั่นน้ำห้อเสมอ (เท่า) กัน แล้วผู้หนึ่งบ่เชื่อย่ำ (นับถือ) คำนั้น กลับไปลักเอาน้ำ เมื่อกลางคืนห้อไหม ๑๑๐ เงิน หรือไปลู่ (แย่ง) เอาเมื่อกลางวันก็ดี กลางคืนก็ดี แล้วมันมีเครื่องมือ (อาวุธ) ทับมือ (อยู่ในมือ) ห้อฆ่ามันเสียที่นั้น ถ้าบ่ฆ่าห้อไหม ๓๓๐ เงิน"*[๓๙]
>
> *"ห้อดีผู้ลู่ (แย่งขโมยไป) ลักห้อจนหัวแตก บ่อันห้อยับ (จับ) ตัวไปหาเจ้าขุนห้อสอนมันตามคอง (ประเพณี) ถ้ามันยังไปลู่ลักเอาน้ำแถมเล่า ห้อฆ่าเสียกับที่นั้น"*[๔๐]

ดังนั้นจะเห็นว่า รัฐบาลคงยอมรับธรรมเนียมประเพณีการแจกจ่ายน้ำสืบต่อกันมานานในสังคมท้องถิ่น รัฐบาลจึงอาจพึ่งพาอาศัยความสามารถในการดำเนินงานของเจ้าขุน ซึ่งอาจจะเป็น

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๓๗) ไกรศรี นิมมานเหมินท์ *เล่มที่อ้างแล้ว* หน้า ๑๒,๑๓ *มังรายศาสตร์* เล่มที่อ้างแล้ว หน้า ๔๗

๓๘) *มังรายศาสตร์* เล่มที่อ้างแล้ว หน้า ๘๕,๑๐๑

๓๙) ไกรศรี นิมมานเหมินท์ *เล่มที่อ้างแล้ว* หน้า ๑๓–๑๔

๔๐) *เล่มเดิม* หน้า ๑๔

ข้าราชการขั้นต่ำในหมู่บ้านนั้น ให้บำรุงรักษาระเบียบการชลประทานได้ ฉะนั้น กล่าวได้ว่าระบบควบคุมการชลประทานนั้น แม้ว่า รัฐบาลจะปรับปรุงเหมืองฝายแบบใหญ่ให้เป็นต้นน้ำมาแล้วก็ยังต้องอาศัยธรรมเนียมประเพณี วิธีการชลประทานในสังคมท้องถิ่น

ระเบียบการชลประทานและวิธีการแจกจ่ายน้ำในสังคมท้องถิ่น ปัจจุบันยังมีในชนบทภาคเหนืออยู่ ในประวัติกระทรวงเกษตราธิการกล่าวไว้ว่า ในหมู่บ้านนั้น มักมีหัวหน้า หรือนายฝายที่ชาวบ้านตั้งขึ้น มีอำนาจที่จะขอแรงใช้สอยในการเหมืองฝาย และซ่อมแซมทำการบำรุงรักษาและไขน้ำให้เต็มที่ นายฝายนั้นมักจะไม่ต้องทำนาเลย มีหน้าที่แต่เพียงตรวจตราดูแลรักษาฝาย ถึงเวลาเก็บเกี่ยวข้าว บรรดาชาวบ้านที่อยู่ในหมู่ หรือคณะ นั้น ต่างคนก็นำเอาข้าวมาให้นายฝาย[๔๑] นักมนุษยวิทยา ที่ทำการวิจัยสังคมท้องถิ่นในภาคเหนือ ส่วนมากจะสังเกตเห็นรายงานประเพณีอย่างนั้นด้วย[๔๒] ฉะนั้น เจ้าขุนที่ทำการบำรุงรักษาการชลประทานในสมัยลานนาไทย อาจจะเป็นผู้มีหน้าที่เหมือนกันนายฝายปัจจุบันนี้

ระเบียบการแจกจ่ายน้ำ หรือ การชลประทานขนาดเล็กในสังคมท้องถิ่น ดำเนินสืบต่อมาตั้งแต่สมัยอาณาจักรลานนาไทยจนถึงปัจจุบัน แต่ลักษณะโครงการสร้างบำรุงรักษาเมืองฝายแบบใหญ่เปลี่ยนแปลงไปเมื่อถึงสมัยรัชการที่ ๕ ในสมัยนั้น Graham สังเกตเห็นการเปลี่ยนแปลงของโครงการเหมืองฝายขนาดใหญ่ จึงบันทึกไว้ว่า ราชวงศ์ หรือเจ้าเมืองซึ่งในสมัยนั้นไม่มีอำนาจแล้ว แต่ยังสังกัดอยู่ในสังคมขุนนาง มักจะสร้างซ่อมแซมเหมืองฝายโดยเกณฑ์แรงชาวนา เวลานั้น เขาจะแจกอาหารให้ชาวนาที่มาร่วมแรงกันทำเหมืองฝาย เสร็จแล้ว เหมืองฝายนั้น ถือว่าเป็นราชวงศ์ หรือเจ้าเมือง และเขาจะเก็บข้าวเป็นค่าน้ำจากเนื้อที่ที่ได้รับประโยชน์จากเหมืองฝายนั้น[๔๓]

โครงการเหมืองฝายเอกชน ซึ่งมีจุดหมายสำหรับเก็บค่าน้ำจากชาวบ้านอย่างนี้ดำเนินต่อมาพร้อมกับการแพร่หลายของระบบเศรษฐกิจการค้า ตั้งแต่ในสมัยรัชกาลที่ ๕[๔๔] เช่นโครงการเหมือง

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๔๑) เจ้าพระยาวงษานุประพันธ์ *เรื่องประวัติกระทรวงเกษตราธิการ* (พระนคร พ.ศ. ๒๔๘๔) หน้า ๒๔๑–๒

๔๒) John E. de Young *Village Life in Modern Thailand*, (Berkeley, 1963), pp. 78–80; Konrad Kingshill, *Ku Daeng–The Red Tomb: A Village Study in Northern Thailand*, (Chiang Mai, 1965), pp.87–8; Gehan Wijiyewardane, "A Note on Irrigation and Agriculture in a North Thai Village", *Felicitation Volumes of Southeast Asian Studies, Vol. II*, (The Siam Society, 1965), pp. 258–9.

๔๓) Graham, *op. cit.*, p. 34.

๔๔) สวัสดิ์ วีระเดชะ *เล่มที่อ้างแล้ว* หน้า ๔๓

ผาแตก ซึ่งเจ้าราชภาคินัย ได้ใช้เงินส่วนตัวลงทุนสร้างขึ้น เลี้ยงนาได้ ๑,๐๑๒ ไร่ ในเขตอำเภอดอยสะเก็ด และอำเภอสันกำแพง จังหวัดเชียงใหม่[๔๕] ขณะเดียวกัน ในสมัยนั้น กระทรวงมหาดไทย ของกรมพระยาดำรงราชานุภาพ ได้ส่งเสริมการสร้างซ่อมแซมเหมืองฝายในเขตเมืองต่าง ๆ ในมณฑลพายัพ เวลาสร้างเหมืองฝายนั้น ข้าหลวงที่ส่งมาจากกรุงเทพฯ สั่งให้พวกที่เคยเป็นเจ้าเมือง หรือ ขุนนางชั้นสูง ในสมัยก่อน เกณฑ์ชาวนา รวมทั้งอุปกรณ์ในการก่อสร้างเหมืองฝายจากชาวบ้าน ดังนั้น จะเห็นว่า ในโครงการรัฐบาล ซึ่งดำเนินงานในเขตเมืองนครลำปาง นครน่าน และเมืองแพร่นี้ ยังใช้วิธีเกณฑ์แรงราษฎรสืบต่อมาแต่ครั้งสมัยก่อน[๔๖]

ดังกล่าวมาแล้ว การชลประทานแบบเหมืองฝาย มีการร่วมแรงกันในสังคมท้องถิ่นเป็นหลัก ชาวนาที่อยู่ในบริเวณหุบเขาทางภาคเหนือได้ทำการชลประทานขนาดเล็กมาโดยการร่วมแรงกันขณะเดียวกัน รัฐบาลก็สร้างเหมืองฝายแบบใหญ่ โดยการเกณฑ์ราษฎร แม้กระทั่ง โครงการสาธารณะประเภทนี้ สำหรับการบำรุงรักษาเหมืองฝาย และการแจกจ่ายน้ำดำเนินงานอยู่ในสังคมท้องถิ่นนั่นเอง

๓. การชลประทานแบบคลอง

๓.๑ การชลประทานในสมัยกรุงศรีอยุธยาและตอนต้นกรุงรัตนโกสินทร์

ในบริเวณทั้งสอง คือบริเวณทุ่งราบลุ่มน้ำเก่า และบริเวณทุ่งราบลุ่มน้ำใหม่ระหว่างแม่น้ำหลายสาย พระมหากษัตริย์สั่งให้ขุดคลองเป็นจำนวนมาก ตั้งแต่ในสมัยอยุธยามาแล้ว แต่สำหรับบริเวณทุ่งราบลุ่มน้ำเก่า ซึ่งมีเมืองสำคัญที่อยู่ในอำนาจของพระมหากษัตริย์อย่างเต็มที่ จะเห็นว่าไม่ค่อยมีโครงการขุดคลองขนาดใหญ่ตลอดในสมัยอยุธยา และสมัยกรุงรัตนโกสินทร์ด้วย เพราะในบริเวณนั้น ชาวนาขุดคลองเล็ก ๆ ทดน้ำเข้ามาในเขตนาได้เองเลยไม่ต้องมีโครงการขนาดใหญ่ บางเมืองในบริเวณนี้มีนาที่ทดน้ำไว้บริบูรณ์ จึงปลูกข้าวได้ทุกปีโดยไม่ต้องอาศัยน้ำฝนโดยเฉพาะ แต่ยังอาศัยน้ำท่าที่ท่วมถึง[๔๗] ฉะนั้น ตั้งแต่แผ่นดินสมเด็จพระนารายณ์มหาราช สำหรับเขตเมืองอย่างนี้จึงเรียกเก็บภาษีค่านาประเภทนาคู่โค ที่ต้องเสียภาษีเต็มเนื้อที่ที่เจ้าของหวงห้าม[๔๘] จนกระทั่ง

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๔๕) แผนกโครงการชลประทานพายัพ *เล่มที่อ้างแล้ว* หน้า ๒

๔๖) กองจดหมายเหตุแห่งชาติ กระทรวงมหาดไทย ๑๘.๒/๑ แผนกเกษตร (การชลประทาน), ที่๒๒๒๘/๑๑๕๔๘ ร.ศ. ๑๒๒ ที่ ๖๖๗/๓๙๔๑ ร.ศ. ๑๒๙ ที่ ๑๐๒๙/๖๓๒๙ ร.ศ. ๑๒๒

๔๗) Simon de la Loubère, *Du Royaume de Siam, tome I*, (Amsterdam, 1691), p. 282.

๔๘) กรมพระยาดำรงราชานุภาพ พ.ศ. ๒๔๖๖ "คำนานภาษีอากรบางอย่าง", *ลัทธิธรรมเนียมต่าง ๆ ภาคที่ ๑๕* (พระนคร ๒๔๖๖) หน้า ๑–๗

ในสมัยกรุงรัตนโกสินทร์ พื้นที่ใช้ปลูกข้าวเป็นนาคู่โค ก็ยังเป็นแนวไม่ต่างกันนัก ร. แลงกาต์ กล่าวว่า *"ในรัชกาลที่ ๓ และที่ ๔ กรุงรัตนโกสินทร์ นาคู่โคนั้นมีอยู่แต่เฉพาะในแขวงอยุธยา ลพบุรี อ่างทอง และสุพรรณบุรี ๔ แขวงเท่านั้น ซึ่งเป็นเมืองที่การทดน้ำเรียบร้อยดี แต่เป็นนาน"*[๔๙]

วิธีการทดน้ำเข้ามาในเขตนานั้น เป็นวิธีการชลประทานขนาดเล็ก ชาวนาในสังคมท้องถิ่นก็ทำได้โดยการร่วมแรงกัน เพราะฉะนั้น จะเห็นว่า รัฐบาลในสมัยนั้นไม่ต้องช่วยเหลือส่งเสริมการชลประทานแบบนั้น แต่เนื่องจากมีความจำเป็นในการรังวัดนา เพื่อเก็บภาษีค่านา รัฐบาลจึงควบคุมการทดน้ำแบบนี้ ฉะนั้น ในพระธรรมนูญ (กฎหมายตราสามดวง)กำหนดไว้ ดังต่อไปนี้ *"ตราพระพิรุณขีนาค ทรงเครื่องยืนหลังนาคราชดวงหนึ่ง สำหรับใช้ไปวิดน้ำเข้านาขุดบึงบางคลองไขน้ำ"*[๕๐] นอกจากการควบคุมการทดน้ำแล้ว รัฐบาลยังตรวจตราสภาพน้ำฝน น้ำท่า และการทำไร่นาอย่างถ้วนถี่แน่นอน ทั้งยังบำรุงรักษาคลองในเขตเมืองสำคัญในบริเวณทุ่งราบลุ่มน้ำเก่าอีกด้วย ภายหลังจนถึงในสมัยรัชกาลที่ ๓ ปรากฏหลักฐานว่ารัฐบาลสมัยนั้น เวลาฝนตกหนักเดือน ๑๑ ได้พยายามไขน้ำให้เข้าในนา แล้วลงทำนบปิดคลองถมดินยกคันคลองคันนาให้กันน้ำไว้อย่าให้ไหลกลับไปสู่ลำน้ำลำคลองได้ โดยการขอแรงราษฎรหรือพวกลาวในเขตแขวงกรุงเก่า เมืองอ่างทอง สระบุรี ลพบุรี นครนายก และสุพรรณเป็นต้น[๕๑]

นอกจากการดำเนินการชลประทาน ซึ่งค่อนข้างเป็นขนาดเล็กเหล่านี้แล้ว ยังมีโครงการขุดคลองขนาดใหญ่อีกด้วย ถ้าหากสังเกตภูมิประเทศ ลำคลองที่ขุดขึ้นตั้งแต่ในสมัยอยุธยา คลองเหล่านี้ส่วนมากอยู่ในบริเวณทุ่งราบลุ่มน้ำใหม่ทางทิศใต้จากอยุธยา ซึ่งเป็นพื้นที่ไม่ค่อยมีคนอยู่นอกจากแถบริมแม่น้ำสายใหญ่ หรือใกล้ๆ ชานเมืองจนกระทั่งในสมัยต้นกรุงรัตนโกสินทร์[๕๒] คลองเหล่านี้ส่วนมากขุดขึ้นเพื่อการคมนาคม เช่น ใช้ประโยชน์เพื่อการค้าขายภายในเมือง และการค้าขายกับต่างประเทศด้วย และเพื่อการขนส่งกองทหาร และการเรียกเก็บภาษีอากรให้สะดวกรวดเร็ว[๕๓] ทั้งในสมัยอยุธยาถึงสมัยรัชกาลที่ ๓ แต่ยังไม่พบหลักฐานว่า พระมหากษัตริย์ให้ขุด

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๔๙) ดร. ร. แลงกาต์ *ประวัติศาสตร์กฎหมายไทย กฎหมายที่ดิน* (มหาวิทยาลัยวิชาธรรมศาสตร์และการเมือง ๒๔๘๓) หน้า ๓๓

๕๐) มหาวิทยาลัยวิชาธรรมศาสตร์และการเมือง *ประมวลกฎหมายรัชกาลที่ ๑ จุลศักราช ๑๑๖๖* พิมพ์ตามฉบับหลวงตรา ๓ ดวง พระนคร เล่ม ๑ หน้า ๑๔๗–๘

๕๑) "เรื่องเกี่ยวกับกรุงเก่า" *ประชุมพงศาวดาร ภาคที่ ๖๔* เล่ม ๔๓ (องค์การคุรุสภา พระนคร ๒๕๑๒) หน้า ๑๗–๒๔

๕๒) De la Loubere, *op. cit.*, pp. 7–8.

๕๓) H. G. Quaritch Wales, *Ancient Siamese Government and Administration*, (London & New York 1934), reprinted 1965, p. 229.

คลองเพื่อการเกษตร ฉะนั้น จะเห็นว่า ในสมัยนั้น ยังไม่มีความต้องการพัฒนาการปลูกข้าวเป็นการใหญ่ โดยมีโครงการขุดคลองขนาดใหญ่ แต่ถึงแม้จะใช้ประโยชน์ในการคมนาคมเป็นส่วนใหญ่ บางทีก็ใช้ประโยชน์ในการปลูกข้าวได้ด้วย[๕๔] เพราะถ้าหากรักษาการคมนาคมให้คงอยู่โดยการขุดคลองตามสมควร ชาวนาก็จะตั้งหมู่บ้านที่ริมคลองนั้นได้สะดวก มีประโยชน์ต่อการขยายการปลูกข้าวได้ด้วย

ลักษณะคลองที่พระมหากษัตริย์ให้ขุดมาจนกระทั่งถึงสมัยรัชกาลที่ ๓ นั้น อาจแบ่งออกเป็น ๓ ประเภท คือ คลองลัด คลองข้ามระหว่างแม่น้ำ และคลองภายในเมือง คลองภายในเมืองนั้น ขุดไว้รอบตัวเมือง กรุงศรีอยุธยา และตัวเมืองกรุงเทพฯ ด้วย เพื่อป้องกันรักษาเขตกรุงหรือเมือง นอกจากนั้น ขุดไว้เพื่อการคมนาคมภายในเมืองให้เป็นระเบียบเรียบร้อยด้วย โครงการคลองลัดที่ขุดตัดให้ย่นระยะทาง ส่วนที่แม่น้ำคดเคี้ยวนักให้ตรงนั้นมีเป็นจำนวนมากที่สุดในสมัยนั้น โครงการนี้ถือได้ว่าเป็นโครงการเปลี่ยนแปลงทางแม่น้ำ เพื่อให้เรือแพผ่านไปมาได้สะดวก ส่วนมากก็ขุดตรงที่แม่น้ำเจ้าพระยาวกไปเวียนมาระหว่างเมืองปทุมธานีและเมืองพระประแดง หรือ เมืองนครเขื่อนขันธ์ ทางทิศใต้ โดยการเกณฑ์แรงไพร่จำนวนมหึมาเป็นหมื่นเป็นแสน เช่น คลองบางกอกใหญ่ ในปี พ.ศ. ๒๐๖๘ คลองลัดบางกรวย ปี พ.ศ. ๒๐๘๑ คลองลัดเมืองนนท์ ปี พ.ศ. ๒๑๗๙ คลองลัดเตร็ดน้อยที่อาจขุดก่อน พ.ศ. ๒๒๓๐ เป็นต้น[๕๕] (ดูแผนที่ ที่ ๓)

นอกจากนั้น มีอีกประเภทหนึ่ง คือ คลองข้ามระหว่างแม่น้ำ ซึ่งขุดไว้เชื่อมติดต่อกับแม่น้ำสองสายที่ไหลมาขนานกัน เช่น สมัยอยุธยา ได้ขุดซ่อมคลองสำโรง ปี พ.ศ. ๒๐๔๒[๕๖] คลองมหาไชยขลมารค เสร็จในสมัยพระเจ้าท้ายสระ ปี พ.ศ. ๒๒๔๗[๕๗] และในสมัยรัชกาลที่ ๓ เช่น คลองสุนัขหอน ที่ขุดระหว่างแม่น้ำท่าจีนกับแม่น้ำแม่กลอง ในปี พ.ศ. ๒๓๑๐[๕๘] คลองแสนแสบ หรือ คลองบางขนากที่ขุดอยู่จนถึง ปี จ.ศ. ๑๒๐๒ (พ.ศ. ๒๓๘๔) ให้เป็นทางไปมาถึงกันในระหว่างกรุงเทพฯ กับแม่น้ำเมืองปราจีนบุรี เป็นทางยาว ๕๓.๕ กิโลเมตร[๕๙] โดยเฉพาะสำหรับ

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๕๔) พรนิภา พฤฒินารากร และทวีศิลป์ สืบวัฒนะ *เล่มที่อ้างแล้ว* หน้า ๔๖–๔๗

๕๕) Shigeharu Tanabe, "Historical Development of Canal System in the Chao Phraya Delta Pt.I," (in Japanese) *Tanan Ajia Kenkyu* (The Southeast Asian Studies), Vol. II, No. I. (1973), pp. 20–30.

๕๖) "พระราชพงศาวดารกรุงศรีอยุธยา ฉบับกรมพระปรมานุชิตฯ" *พระราชพงศาวดารกรุงศรีอยุธยา และพงศาวดารเหนือ* (องค์การคุรุสภา พ.ศ. ๒๕๐๔) เล่ม ๑ หน้า ๔๘

๕๗) *เล่มเดิม* หน้า ๒๐๔–๒๐๖, ๒๑๘–๒๑๙

๕๘) เจ้าพระยาทิพากรวงศ์ *พระราชพงศาวดารกรุงรัตนโกสินทร์ ฉบับหอสมุดแห่งชาติ* รัชกาลที่ ๓ ฯ รัชกาลที่ ๔ ฯ (คลังวิทยา ๒๕๐๖) หน้า ๔๒–๓

๕๙) *เล่มเดิม* หน้า ๑๗๙

คลองแสนแสบนั้น ขุดไว้แต่เพียงใช้ประโยชน์เพื่อการส่งเสบียงอาหารและการไปมาให้รวดเร็วในเวลาสงครามระหว่างประเทศสยามกับเขมร และญวน[๖๐] แต่หลังจากนั้นจะเห็นว่าผลของการขุดคลองสายนั้น เป็นสิ่งชักจูงและสนับสนุนให้ชาวนาพากันอพยพมาตั้งถิ่นฐานทำนากันในแถบริมคลองนั้น

การขุดซ่อมแซมคลองเหล่านี้ ในสมัยต่อมา พระมหากษัตริย์ได้เกณฑ์แรงไพร่เป็นจำนวนมาก ต่อมาถึงในสมัยกรุงรัตนโกสินทร์ ระบบเศรษฐกิจการค้าค่อย ๆ แพร่หลายขึ้นตามสมควร ยิ่งกว่านั้น กลุ่มคนจีนที่เป็นกรรมกรค่าแรงงานถูก อพยพเข้ามาในเมืองไทยเพิ่มขึ้นตั้งแต่สมัยรัชกาลที่ ๑ เพราะฉะนั้น ในการขุดซ่อมคลอง กรรมกรคนจีนจึงรับจ้างแทนไพร่คนไทย โดยเฉพาะตั้งแต่สมัยรัชกาลที่ ๓ เป็นต้นมา[๖๑]

ดังได้กล่าวมาแล้ว ในสมัยตั้งแต่กรุงศรีอยุธยาจนมาถึงตอนต้นกรุงรัตนโกสินทร์ ลักษณะมูลฐานของการชลประทานคงจะเป็นการชลประทานขนาดเล็ก ที่ชาวนาในสังคมท้องถิ่นจัดทำ และบำรุงรักษาได้ อีกอย่างหนึ่ง รัฐบาลของพระมหากษัตร์สนใจสภาพน้ำฝน น้ำท่า และสภาพไร่นาอยู่เสมอเป็นประจำ และช่วยเหลือทำการชลประทานในเขตเมืองเฉพาะแต่ในบริเวณทุ่งราบลุ่มน้ำเก่า ซึ่งเป็นพื้นที่ที่การทดน้ำเรียบร้อยอยู่แล้ว และที่รัฐบาลคาดว่าจะเรียกเก็บภาษีอากรได้เป็นจำนวนมาก สำหรับโครงการขุดซ่อมคลองขนาดใหญ่ อาจกล่าวได้ว่า มีจุดมุ่งหมายเพื่อพัฒนาการคมนาคมโดยตรง จะเห็นว่ารัฐบาลมีเจตนาที่จะรักษาสภาพการณ์ต่าง ๆ ให้เคลื่อนไหวหมุนเวียนอยู่เสมอ แม้ว่าจะใช้ประโยชน์ในการชลประทานด้วยจุดมุ่งหมายนั้นเป็นแต่เพียงโดยปริยาย ฉะนั้น โครงการขุดซ่อมคลองขนาดใหญ่ ในสมัยนั้นยังไม่เกี่ยวข้องกับการพัฒนาการเพาะปลูกเลย

๓.๒ การพัฒนาการขุดคลองในสมัยรัชกาลที่ ๔ และที่ ๕

เมื่อถึงสมัยรัชกาลที่ ๔ นับแต่ได้ทำสัญญาทางการค้ากับต่างประเทศ ในปี พ.ศ. ๒๓๙๘ แล้วเป็นต้นมา การค้าขายภายในเมืองและการค้าขายกับต่างประเทศได้เจริญขึ้น ฉะนั้น ตั้งแต่รัชสมัยรัชกาลที่ ๔ เป็นต้นมา ผลิตผลทางการเกษตรที่จะเป็นสินค้าส่งไปขายต่างประเทศ เช่น น้ำตาล ข้าว พริกไทย เป็นต้นนั้น เพิ่มขึ้นเฉพาะในบริเวณทุ่งราบลุ่มน้ำทั้งสอง แม้กระนั้นก็ดี ยังไม่

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๖๐) เจ้าพระยาวงษานุประพันธ์ *เล่มที่อ้างแล้ว* หน้า ๑๓๓

๖๑) เจ้าพระยาทิพากรวงศ์ *เล่มที่อ้างแล้ว* หน้า ๙๒, ๔๓๖; G. William Skinner, *Chinese Society in Thailand: An Analytical History*, (Ithaca, 1957), p. 114

ปรากฏให้เห็นว่า การผลิตข้าวเพิ่มขึ้นทันตาอย่างน่าพิศวง ถ้าหากสังเกตถึงการเปลี่ยนแปลงของโครงการขุดคลอง จะเห็นว่า ในสมัยรัชกาลที่ ๔ การขุดคลองคงจะมีจุดประสงค์เพื่อการขนส่งอ้อยและน้ำตาล อีกด้วย ไม่ใช่การชลประทานเพื่อการปลูกข้าวเท่านั้น

สำหรับการปลูกอ้อย ปรากฏหลักฐานว่าในสมัยรัชกาลที่ ๓ มีโรงงานขนาดใหญ่ของคนจีนเพื่อการผลิตน้ำตาลที่เมืองนครชัยศรีแล้ว[๖๒] จากบัญชีรายชื่อสินค้าที่ส่งไปขายต่างประเทศที่เรียบเรียงโดย Malloch นับตั้งแต่ราวในปี พ.ศ. ๒๓๙๓ จนถึง พ.ศ. ๒๔๑๐ น้ำตาลและสินค้าทำด้วยน้ำตาลคงเป็นสินค้าสำคัญที่สุด[๖๓] แต่มาถึง พ.ศ. ๒๔๑๐ เป็นต้นมา เพราะเหตุภยันตรายทางแถบนครชัยศรี และเนื่องจากการขายน้ำตาลราคาถูกของชวาอย่างแพร่หลาย ทำให้การผลิตน้ำตาลไทยลดลงอย่างรวดเร็ว[๖๔]

อย่างไรก็ตาม ในสมัยรัชกาลที่ ๔ มีการขุดคลองเจดีย์บูชาในเขตเมืองนครชัยศรีที่เป็นแหล่งผลิตอ้อยใหญ่ที่สุด[๖๕] สำหรับคลองเจดีย์บูชานั้น หนังสือ*ประวัติกระทรวงเกษตราธิการ* ได้อ้างว่า พระมหากษัตริย์ทรงให้ขุดคลองนั้นขึ้น โดยมีพระราชประสงค์ให้ประชาชนไปมานัสการพระปฐมเจดีย์ได้โดยสะดวก[๖๖] แต่กระนั้น จะเห็นว่าคงมีความมุ่งหมายเพื่อการรักษาการขนส่งอ้อยและน้ำตาลอีกด้วย

ต่อมาเมื่อการผลิตน้ำตาลลดน้อยลง และราคาข้าวค่อย ๆ สูงขึ้น รัฐบาลจึงดำเนินงานโครงการขุดคลอง ซึ่งมีความมุ่งหมายอย่างชัดเจนว่าจะทำให้ที่ดินที่รกร้างว่างเปล่ากลายเป็นนาในบริเวณทุ่งราบลุ่มน้ำใหม่ คือ คลองมหาสวัสดิ์ เสร็จในปี พ.ศ. ๒๔๐๓[๖๗] คลองภาษีเจริญ ปี พ.ศ. ๒๔๐๙ เสร็จในปี พ.ศ. ๒๔๑๕[๖๘] คลองดำเนินสะดวก ปี พ.ศ. ๒๔๑๑[๖๙] (ดูแผนที่ ที่ ๕)

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๖๒) Mgr. Pallegoix, *Description du Rayaume Thai ou Siam*, (Faris, 1854) tome I, pp. 101–2; Frederick A. Neal, *Narrative of a Residence in Siam*, (London, 1852), pp. 68–9.

๖๓) D.E. Malloch, *Siam: Some General Remarks on its Productions*, (Calcutta, 1852), pp, 46–7.

๖๔) Ministry of Commerce and Communications, *op.cit.*, pp, 220–1; Credner, *op.cit.*, p. 241.

๖๕) เจ้าพระยาทิพากรวงศ์ *เล่มที่อ้างแล้ว* หน้า ๘๐๔–๕

๖๖) เจ้าพระยาวงษานุประพันธ์ *เล่มที่อ้างแล้ว* หน้า ๑๓๓–๔

๖๗) เจ้าพระยาทิพากรวงศ์ *เล่มที่อ้างแล้ว* หน้า ๕๓๐–๑ "เรื่องสถานที่และวัตถุซึ่งสร้างในรัชกาลที่ ๔" *ประชุมพงศาวดาร ภาคที่* ๒๕ เล่ม ๑๔ (องค์การค้าคุรุสภา ๒๕๐๗) หน้า ๒๔๕

๖๘) "ประกาศขุดคลองภาษีเจริญ" เสถียร ลายลักษณ์ *ประชุมกฎหมายประจำศก* (พระนคร ๒๔๗๘) เล่ม ๗ หน้า ๑๕๔; เจ้าพระยาทิพากรวงศ์ *เล่มที่อ้างแล้ว* หน้า ๖๗๑

๖๙) *เล่มเดิม* หน้า ๗๑๑

ดังนั้น คลองเหล่านี้จึงใช้ประโยชน์ในการชลประทานในเขตฝั่งตะวันตกแม่น้ำเจ้าพระยา แต่ลักษณะการชลประทานจากคลองเหล่านี้ ยังไม่ใช่งานชลประทานโดยแท้จริง คลองที่ขุดจะส่งน้ำเข้าไปในเขตนาได้ต่อเมื่อน้ำในแม่น้ำหนุนท่วมขึ้นมาเท่านั้น เรียกได้ว่า คือ Innundation Canal[๗๐] คลองเหล่านี้คงมีประโยชน์ต่อการขยายเนื้อที่ที่จะใช้ทำนามากขึ้น แม้กระนั้น กล่าวไม่ได้ว่า พวกชาวนาเข้ามาจับจองที่ดินริมคลองเหล่านี้เมื่อขุดคลองเสร็จแล้ว พระมหากษัตริย์มักจะพระราชทานที่ดินริมคลองแก่พระราชวงศ์ และขุนนางข้าราชการชั้นสูง ในสมัยนั้น ที่ดินเหล่านี้ มักจะถูกปล่อยเป็นที่รกร้างว่างเปล่า ยังไม่ได้กลายเป็นที่ให้ผลประโยชน์

สำหรับที่ดินริมคลองมหาสวัสดิ์ เมื่อได้ขุดสำเร็จแล้ว ในปี พ.ศ. ๒๔๐๔ จึงโปรดเกล้าฯ ยกที่นาทั้งสองฝั่งคลองนี้ พระราชทานแก่สมเด็จพระเจ้าลูกยาเธอ และพระเจ้าลูกเธอ และให้บ่าวไพร่ไปตั้งทำนา หรือจะให้ผู้อื่นเข้าทำก็ตาม[๗๑] (ดูแผนที่ ที่ ๔) ภายหลังสมัยรัชกาลที่ ๕ ปรากฏหลักฐานเกี่ยวกับเรื่องนี้ในจดหมายเหตุของกรมหลวงดำรงราชานุภาพ อยู่ในกองจดหมายเหตุแห่งชาติว่า *"ในเวลานั้นคนทำนายังมีน้อย ที่รกร้างว่างเปล่ามีมาก ผู้ที่ไปตั้งทำนาก็ทำแต่พอกำลังไม่เต็มเนื้อที่ ที่พระราชทาน ในขั้นแรกจึงเป็นการเรียบร้อยไม่ล่วงล้ำกัน ครั้นต่อมาภายหลังข้าวมีราคา และที่นารายนี้มาดีขึ้นตั้งแต่ ร.ศ. ๑๑๕ มา มีผู้ไปตั้งทำนามากขึ้นจนเต็มเนื้อที่ จึงได้เกิดรุกล้ำกันด้านข้างแลปลายนาเป็นหลายราย จนต้องโปรดเกล้าฯ ให้ออกไปจัดการปักปันในครั้งนี้"*[๗๒]

หลักฐานนี้เป็นหลักฐานว่า ในสมัยนั้น ยังดำเนินการพัฒนาที่ดินไม่ได้ โดยอาศัยแต่เพียงแรงพวกไพร่ หรือทาส[๗๓] แม้ว่าจะมีคลองเหล่านี้ เพื่อทำให้เนื้อที่กว้างขวางกลายเป็นนา ฉะนั้น จึงต้องมีชาวนาอิสระที่เกิดจากการแก้ไขการปกครองในสมัยตอนปลายรัชกาลที่ ๕ ดังนั้น อาจกล่าวได้ว่า การพัฒนาที่ดินโดยการขุดคลองในสมัยนั้นเจริญก้าวหน้าได้เฉพาะแต่ภายในระบบเศรษฐกิจของเจ้าขุนมูลนาย

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๗๐) J–Homan van der Heide, *General Report on Irrigation and Drainage in the Lower Menam Valley*, (Bangkok, 1903), p. 27.

๗๑) "ประกาศร่างพระราชหัตถเลขาพระราชทานนาพระเจ้าลูกเธอ", *ประชุมกฎหมายประจำศก* เล่มที่ ๖ หน้า ๒๗๓–๔

๗๒) กองจดหมายเหตุแห่งชาติ กระทรวงเกษตราธิการ ๓.๓/๓๑ ๑/๒๔๐ กรมหลวงดำรงราชานุภาพเรื่องที่นาในคลองมหาสวัสดิ์ รายงานกราบบังคมทูล ฯ ที่ ๗๒/๒๔๑๒ ร.ศ. ๑๒๒

๗๓) Diloek, Prinz von Siam, *Die Landwirtschaft in Siam*, (Leipzig, 1908), pp. 96–7; Ammar Siamwalla, *Land, Labour and Capital in the Three Rice–Growing Deltas of Southeast Asia 1800–1940*, Economic Growth Center Discussion Paper No. 150, (Yale Univ., 1972), p. 23

แต่สำหรับการพัฒนาการคมนาคมนั้น จะกล่าวได้ว่า ในสมัยรัชกาลที่ ๔ รวมคลองที่ขุดแล้ว ตั้งแต่สมัยกรุงศรีอยุธยาด้วย ก็เจริญขึ้นเป็นระเบียบการคมนาคมทางน้ำเฉพาะในเขตฝั่งตะวันตก แม่น้ำเจ้าพระยา ต่อมาถึงสมัยรัชกาลที่ ๕ ขุดคลองสำคัญหลายแห่งในเขตฝั่งตะวันออกแม่น้ำเจ้าพระยาอีกด้วย เช่น คลองนครเนื่องเขตร์ ซึ่งขุดขึ้นในปี จ.ศ. ๑๒๓๙ (พ.ศ. ๒๔๒๐) เพื่อรักษาทางคลองไปมาแต่กรุงเทพฯ ถึงเมืองฉะเชิงเทราที่เป็นแหล่งผลิตข้าวใหญ่มาก[๗๔] และคลองประเวศบุรีรมย์ ซึ่งขุดสำเร็จในปี จ.ศ. ๑๒๔๒ (พ.ศ. ๒๔๒๓) เชื่อมติดต่อกรุงเทพฯ กับเมืองฉะเชิงเทรา โดยตรงสะดวก[๗๕] ดังนั้นระเบียบการคมนาคมทางน้ำ จึงสร้างเสร็จในเขตทุ่งราบลุ่มน้ำใหม่ทั่วไป จนกระทั่งราวปี พ.ศ. ๒๔๓๐ ในสมัยรัชกาลที่ ๕ ขณะเดียวกัน รัฐบาลพยายามบำรุงรักษาคลองสำคัญเหล่านี้จึงประกาศ *"พระราชบัญญัติธรรมเนียมคลองมีอยู่ ๑๐ ข้อ"* ในปี จ.ศ. ๑๒๓๒ (พ.ศ. ๒๔๑๓)[๗๖] รักษาการคมนาคนทางคลองให้คงอยู่เพื่อการขนส่งสินค้าสำคัญ เช่น ข้าว

มาถึงราวปี พ.ศ. ๒๔๒๐ ในสมัยรัชกาลที่ ๕ จึงมีการเปลี่ยนแปลงนโยบายในการขุดคลอง รัฐบาลมาเข้าใจว่า การถือครองที่ดินใหญ่ของเจ้าขุนมูลนายที่ดำเนินมาคู่กับโครงการขุดคลองนั้น ยังไม่ได้ประโยชน์ต่อการขยายเนื้อที่ที่ใช้ทำนาเลย ฉะนั้น ในปี พ.ศ. ๒๔๒๐ จึงออกกฎข้อบังคับวางระเบียบในการขุดคลอง คือ *"ประกาศขุดคลอง จ.ศ. ๑๒๓๙"* ในประกาศ ฉบับนี้แจงข้อบกพร่องในการขุดคลองดังต่อไปนี้ว่า *"การขุดคลองแต่ก่อนโปรดเกล้า ฯ ตั้งนายงาน จ้างเถ้าแก่ขุดคลอง คลองหนึ่งก็เป็นเงินหลายร้อยชั่ง...แต่คลองซึ่งขุดแต่ก่อน ข้าเจ้าบ่าวข้าราชการจับจองที่นาไว้มาก ๆ เกินกำลังทำไม่หมดหวงแหนที่ไว้ให้รกร้างว่างเปล่าไม่เป็นประโยชน์แก่แผ่นดินและราษฎรทั่วไป เพราะเจ้าของผู้จับจองนาไว้ ถือใจเสียว่าได้เปล่า จึงไม่มีความอุตสาหะปลูกสร้างเป็นนาเป็นไร่เป็นสวนให้ที่นาที่ไร่ที่สวนเป็นผลประโยชน์ ครั้นผู้อื่นที่มีความอุตสาหะจะจับจองทำบ้าง ก็ไม่ได้ด้วยมีเจ้าของหวงแหนอยู่ และเป็นที่ก่อการวิวาทด้วยแย่งชิงกันจับจองทับโฉนดตราแดงในจองซึ่งกันและกันเป็นดังนี้โดยมาก"*[๗๗]

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๗๔) "ประกาศคลองนครเนื่องเขตร์", *ประชุมกฎหมายประจำศก* เล่ม ๙ หน้า ๒๐๒--๔; "ประกาศเบิกคลองนครเนื่องเขตร์", *ประชุมกฎหมายประจำศก* เล่ม ๙ หน้า ๒๓๐

๗๕) เจ้าพระยาวงษานุประพันธ์ *เล่มที่อ้างแล้ว* หน้า ๑๔๐--๑

๗๖) "พระราชบัญญัติธรรมเนียมคลองมีอยู่ ๑๐ ข้อ", *ประชุมกฎหมายประจำศก* เล่ม ๘ หน้า ๒๙--๓๘

๗๗) "ประกาศขุดคลอง จ.ศ. ๑๒๓๙", *ประชุมกฎหมายประจำศก* เล่ม ๙ หน้า ๒๒๑--๒

ดังนั้น เพราะเหตุเพื่อเตรียมระงับการถือครองที่ดินผืนใหญ่อย่างแต่ก่อน และเนื่องจากความจำเป็นที่จะต้องลดรายจ่ายเงินหลวงในการขุดคลองลง รัฐบาลจึงให้เจ้าพนักงานกรมนา หรือข้าหลวง และกรรมการพิจารณาไล่เลียงดูว่า ผู้ขอจองที่ดินมีความสามารถทำได้ตามที่ขอหรือทำได้เพียงใด แล้วออกหนังสือสำคัญใหม่ คือโฉนดจอง ให้ราษฎรจองที่ดินริมคลองที่จะขุดใหม่ ยิ่งกว่านั้น ให้ราษฎรที่จะตั้งทำนาที่ริมคลองนั้น ลงแรง หรือออกเงินช่วยในการขุดคลอง หลังจากออกประกาศนั้น รัฐบาลใช้นโยบายนี้ต่อโครงการขุดคลองต่าง ๆ ทางฝั่งตะวันออก เช่น คลองนครเนื่องเขตร์ คลองประเวศบุรีรมย์ คลองเปรง[๗๘] ทางฝั่งตะวันตก เช่น คลองทวีวัฒนา[๗๙] และคลองนราภิรม[๘๐] เป็นต้น ถ้าหากสังเกตภูมิประเทศที่คลองขุดขึ้นมานั้น ส่วนมากอยู่ในเฉพาะบริเวณทุ่งราบลุ่มน้ำใหม่ตอนบน ซึ่งเป็นพื้นที่ที่เหมาะสมในการตั้งหมู่บ้าน และการปลูกข้าวกว่าบริเวณตอนล่าง ฉะนั้น อาจกล่าวได้ว่า การพัฒนาการขุดคลองดำเนินมาในบริเวณทุ่งราบลุ่มน้ำใหม่ตอนบนก่อนอื่น (ดูแผนที่ ที่ ๒)

เมื่อถึงราวปี พ.ศ. ๒๔๓๐ ข้าวส่งไปขายต่างประเทศเป็นจำนวนเพิ่มขึ้น ราคาข้าวก็สูงขึ้นอย่างสม่ำเสมอมั่นคง[๘๑] ขณะเดียวกันราคาที่ดินริมคลอง เฉพาะที่ใกล้ ๆ กรุงเทพ ฯ นั้นสูงขึ้นอีกด้วย[๘๒] คือว่า ที่ดินริมคลองที่จะทำนาได้นั้น กลายมาเป็นสินค้าสำคัญพร้อมกับการแพร่หลายของระบบเศรษฐกิจการค้า เพราะฉะนั้นลักษณะโครงการขุดคลองที่เคยเป็นโครงการสาธารณะของรัฐบาลนั้น จึงกลายเป็นลักษณะโครงการเอกชน ซึ่งมีความโน้มเอียงเป็นกิจการค้าแบบฉวยโอกาส ดังนั้น พระราชทานพระบรมราชานุญาตให้เอกชน หรือบริษัทขุดซ่อมแซมคลองเป็นอันมากขึ้น โดยเฉพาะสำหรับโครงการลงทุนสร้างขึ้นใหม่ตามสัญญา ทรงพระกรุณาโปรดเกล้า ฯ ยอมให้เอกชน หรือ บริษัทจับจองที่ดินริมคลองนั้นทั้งสองฝั่ง อีกฝ่ายหนึ่งสำหรับโครงการซ่อมคลองเก่า ยอมให้เก็บค่าธรรมเนียมแก่เรือที่ผ่านไปมาในคลองนั้น และยอมให้จัดการทุกประการเพื่อบำรุงรักษาคลองนั้น ดังนั้น จึงเกิดมีโครงการขุดคลองที่ดำเนินงานโดยเอกชน ซึ่งส่วนมากเป็นพระราชวงศ์หรือข้าราชการชั้นสูงและคนจีนที่ร่ำรวย[๘๓]

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๗๘) เจ้าพระยาวงษานุประพันธ์ *เล่มที่อ้างแล้ว* หน้า ๑๔๕–๖

๗๙) "ประกาศเบิดคลองทวีวัฒนา จ.ศ. ๑๒๔๐", *ประชุมกฎหมายประจำศก* เล่ม ๑๐ หน้า ๑๒

๘๐) เจ้าพระยาวงษานุประพันธ์ *เล่มที่อ้างแล้ว* หน้า ๑๔๓–๕

๘๑) James C. Ingram, *Economic Change in Thailand 1850–1970*, (Stanford, 1971), pp. 37–8.

๘๒) Dilock, *op.cit.*, pp. 99–100; Graham, *op.cit.*, p. 15.

๘๓) "สัญญาพระราชทานพระบรมราชานุญาทขุดคลอง พ.ศ. ๒๔๓๑", *ประชุมกฎหมายประจำศก* เล่ม ๑๑ หน้า ๒๓๗–๔๔

โครงการใหญ่ที่สุดในแบบอย่างนี้เป็นโครงการรังสิต *คอมปนีขุดคลองแลคูนาสยาม* ได้รับพระราชทานพระบรมราชานุญาต ให้ขุดคลองแลคูนาขึ้นในทุ่งหลวงระหว่างแม่น้ำเจ้าพระยากับแม่น้ำนครนายก และให้บริษัทนี้จับจองที่ดินที่ห่างจากฝั่งคลอง ๑ เส้น ยันขึ้นไปได้ฝั่งละ ๔๐ เส้น ทั้งนี้ เฉพาะแต่ที่ว่างเปล่าที่ไม่มีโฉนดตราแดง ตราจองเป็นที่หวงห้าม[๙๔] บริษัทขายที่ดินที่จัดให้มีการชลประทานเรียบร้อย โดยคลองซอยต่าง ๆ หลายสิบคลองแล้วนั้นแก่ผู้ที่อยู่ในกรุงเทพ ฯ ซึ่งให้คนอื่นหรือชาวนาเช่า บางท่านกล่าวว่า ชาวนาได้พากันเข้าไปตั้งทำนาในทุ่งนี้เป็นอันมาก นับด้วยหมื่น[๙๕]

ดังนั้น โครงการขุดคลองเอกชนอย่างนี้ ดำเนินมาโดยเฉพาะในทุ่งระหว่างคลองสำคัญที่ขุดมาแล้ว และในบริเวณทุ่งราบลุ่มน้ำใหม่ตอนล่าง ซึ่งเป็นพื้นที่ที่ควรจะพัฒนาการปลูกข้าวเป็นแหล่งสุดท้าย เช่น คลองอุดมชนจร ในปี จ.ศ. ๑๒๕๐ (พ.ศ. ๒๔๓๑)[๙๖] คลองหลวงแพ่ง ปี จ.ศ. ๑๒๕๐ (พ.ศ. ๒๔๓๑)[๙๗] คลองเจริญ[๙๘] คลองพระราชาภิมล[๙๙] คลองพระยาบรรฦๅ[๑๐๐] และคลองบางพลีใหญ่[๑๐๑] เป็นต้น (ดูแผนที่ ที่ ๖) นอกจากนี้มีโครงการซ่อมแซมโดยเอกชนอีกด้วย เช่น คลองภาษีเจริญ และคลองดำเนินสะดวกโครงการเอกชนเหล่านี้มักจะก่อสร้างไม่สำเร็จ เพราะเหตุขาดแคลนทุนทรพย์ อย่างไรก็ตามโครงการขุดคลองดำเนินมาอย่างนี้ จนกระทั่งเมื่อตั้งกรมคลองในกระทรวงเกษตราธิการ ในปี ร.ศ. ๑๒๑ (พ.ศ. ๒๔๔๕) โดยมี J.H. Van Der Heide เป็นเจ้ากรม.

ชีเกฮารุ ทานาเบ้

นักวิจัยด้านชาติพันธุ์วิทยาประจำพิพิธภัณฑสถานแห่งชาติ

เมืองโอซากา ประเทศญี่ปุ่น

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๙๔) *เล่มเดิม* หน้า ๒๓๗ ; กร. ร. แลงกาท์ *เล่มที่อ้างแล้ว* หน้า ๘๐

๙๕) เจ้าพระยาวงษานุประพันธ์ *เล่มที่อ้างแล้ว* หน้า ๑๔๔

๙๖) *เล่มเดิม* หน้า ๑๔๘–๙ กองจดหมายเหตุแห่งชาติ กระทรวงเกษตราธิการ ๙.๒/๓, ๕/๑๕๒ เรื่องขออนุญาตขุดคลองตำบลต่าง ๆ ร.ศ. ๑๐๙

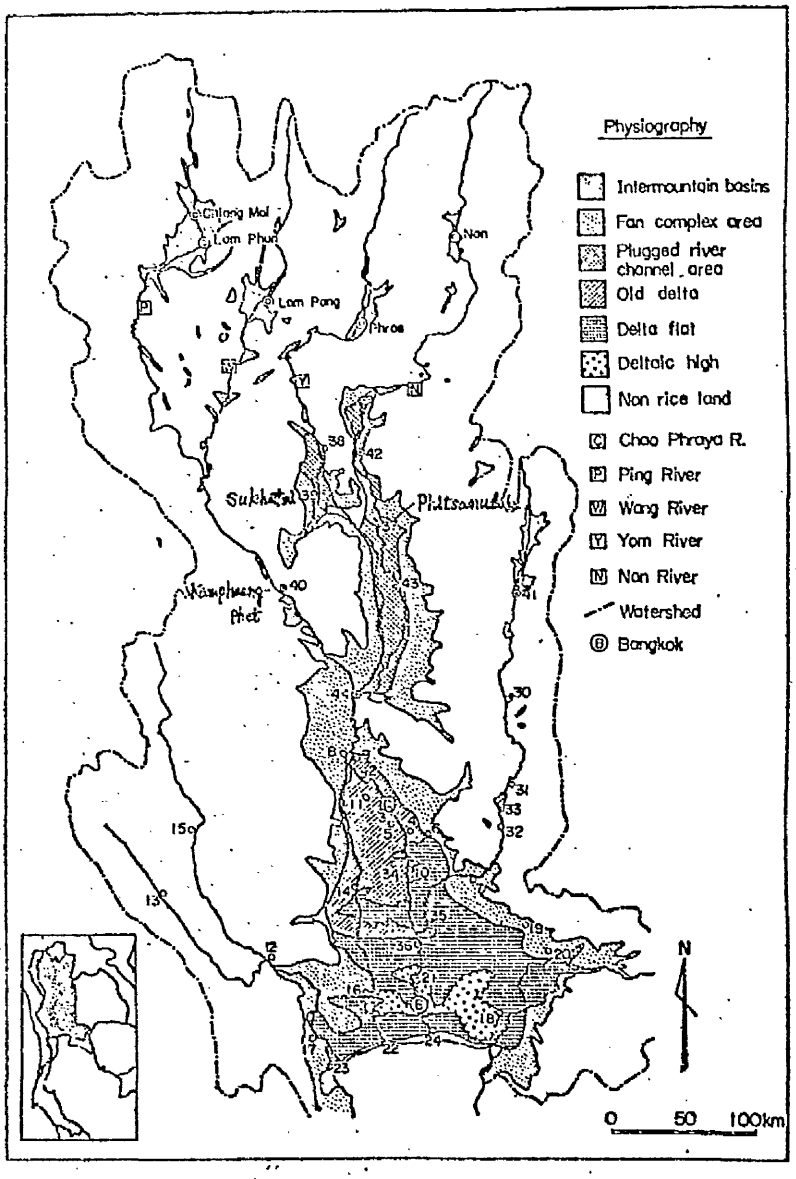
๙๗) เจ้าพระยาวงษานุประพันธ์ *เล่มที่อ้างแล้ว* หน้า ๑๔๙–๕๐

๙๘) *เล่มเดิม* หน้า ๑๕๔ ; เรื่องขออนุญาตขุดคลองตำบลต่าง ๆ *เล่มที่อ้างแล้ว*

๙๙) กองจดหมายเหตุแห่งชาติ กระทรวงเกษตราธิการ ๙.๒/๗, ๓/๑๕๒, เรื่องพระราชาภิมลขออนุญาตขุดคลอง ฯ

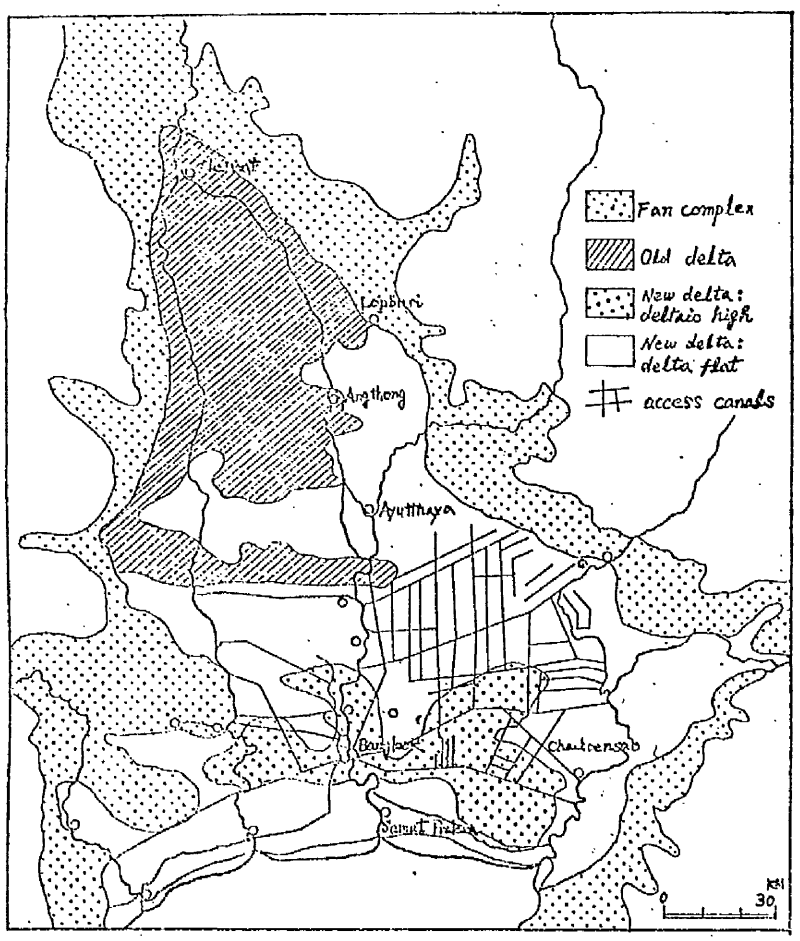
๑๐๐) เจ้าพระยาวงษานุประพันธ์ *เล่มที่อ้างแล้ว* หน้า ๑๕๑–๒

๑๐๑) *เล่มเดิม* หน้า ๑๕๒–๓


Physiography
Intermountain basins
Fan complex area
Plugged river channel area
Old delta
Delta flat
Deltaic high
Non rice land
C Chao Phraya R.
P Ping River
W Wang River
Y Yom River
N Nan River
Watershed
B Bangkok
Chiang Mai
Lam Phun
Lam Pang
Phrae
Nan
Sukhothai
Phitsanulok
Kamphaeng-phet
N
0 50 100km

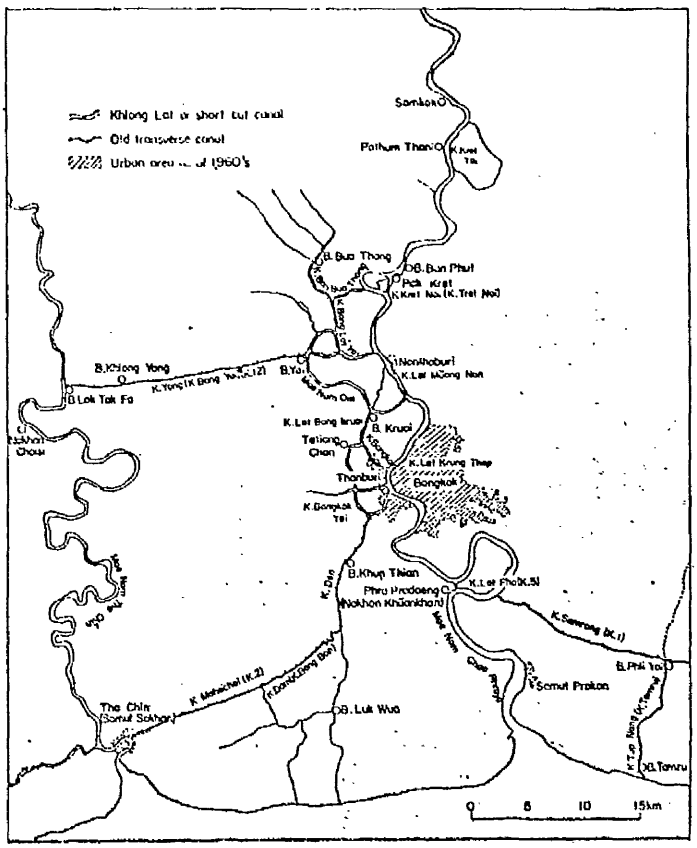
ธ๑(๗)

แผนที่ ที่ ๒



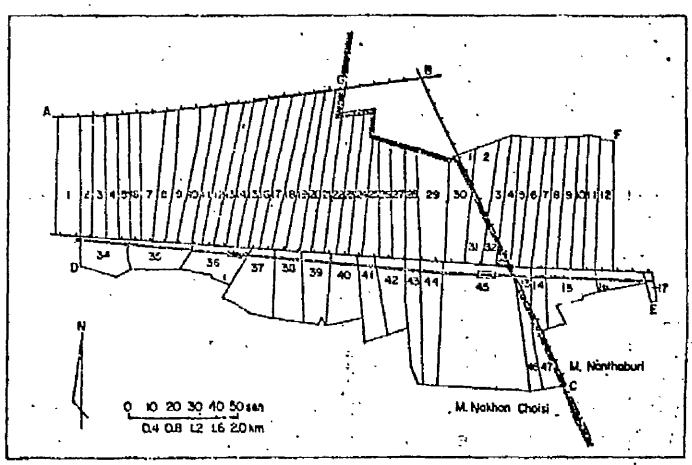
: Physiographic Regions and Canals in the Chao Phraya Delta.

แผนที่ ๓



Short-cut Canals and Old Transverse Canals in Ayutthayan Period

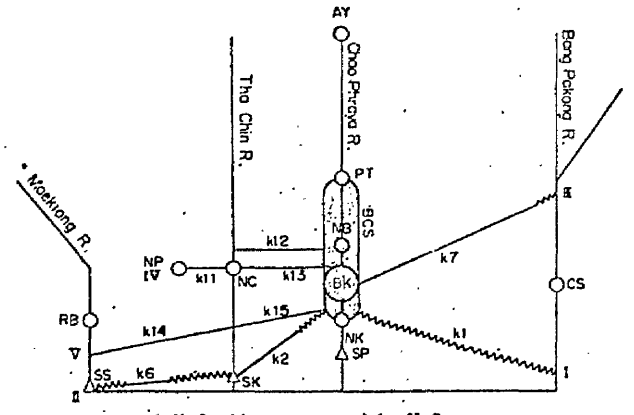
แผนที่ ๔



Land Register Map of the Mahasawat Canal Region, R.S. 122 (1903 A.D.); *from* Damrong (1993).

๕๓ (93)

แผนที่ ๘

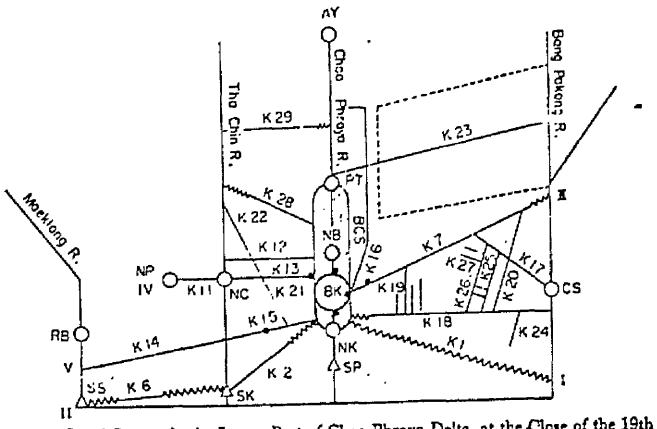


BCS: The Existing Bangkok Outskirts Canal System
AY : Ayutthaya
PT : Pathum Thani
NB : Nonthaburi
BK : Bangkok
NK : Nakhon Khūankhan (Phra Pradaeng)
SP : Samut Prakan
CS : Chachoensao
NC : Nakhon Chaisi
NP : Nakhon Pathom
SK : Sakhonburi (Samut Sakhon)
RB : Ratburi
SS : Samut Songkhram

k 1 : K. Samrong
k 2 : K. Mahachai
k 6 : K. Sunak Hon
k 7 : K. Saen Saep
k 11: K. Chedi Bucha
k 12: K. Yong
k 13: K. Mahasawat
k 14: K. Damnoen Saduak
k 15: K. Phasi Charoen
○ : Krung (Capital)
o : Huamūang (Provincial town)
△ : Huamūang Paknam (Fortfied town on the mouth of river)

The Canal System in the Lower Part of the Chao Phraya Delta, in the mid-19th Century

แผนที่ ๙



The Canal System in the Lower Part of Chao Phraya Delta, at the Close of the 19th C.

BCS: Bangkok Outskirts Canal System
AY : Ayutthaya
PT : Pathum Thani
NB : Nonthaburi
BK : Bangkok
NK : Nakhon Khūankhan (Phra Pradaeng)
SP : Samut Prakan
CS : Chachoengsao
NP : Nakhon Pathom
NC : Nakhon Chaisi
SK : Sakhonburi (Samut Sakhon)
RB : Ratburi
SS : Samut Songkhram
○ : Krung (Capital)
o : Huamūang (Town)
△ : Huamūang Paknam (Fort-town)
• : Danphasi Phainai (Internal Transit Custom)
k 1 : K. Samrong
k 2 : K. Mahachai
k 6 : K. Sunak Hon
k 7 : K. Saen Saep
k11 : K. Chedi Bucha
k12 : K. Yong
k13 : K. Mahasawat
k14 : K. Damnoen Saduak
k15 : K. Phasi Charoen
k16 : K. Prem Prachakon
k17 : K. Nakhon Nūang Khet
k18 : K. Prawet Burirom
k19 : K. 1, K. 2, K. 3, K. 4
k20 : K. Preng
k21 : K. Thawi Watthna
k22 : K. Naraphirom
k23 : K. Rangsit
k24 : K. Niyom Yatra
k25 : K. Udom Chanchon
k26 : K. Luang Phaeng
k27 : K. Charoen
k28 : K. Phra Rachaphimon
k29 : K. Phraya Banrū

HISTORICAL GEOGRAPHY OF THE CANAL SYSTEM IN THE CHAO PHRAYA RIVER DELTA

From the Ayutthaya period to the fourth reign of the Ratanakosin dynasty

by

Shigeharu Tanabe*

A. Introduction

The large, complex delta stretching from Chainat Province to the Gulf of Thailand, customarily called the Chao Phraya delta, consists of flat, open land watered by the lower reaches of the Chao Phraya, Tha Chin, Maeklong and Bang Pakong rivers. Throughout the Ayutthaya and Ratanakosin periods of Siamese history, the delta was the center of geographical living-space on which the society's agricultural production depended. This article aims at analyzing historical change in the Chao Phraya delta by investigating the formative process of the canal system, before the introduction of the irrigation/transportation system operated by the Krom Khlong ("Department of Canals") during the Ratanakosin period.

Both the agricultural production, characterized by wet-rice cultivation, and the transportation facilities on which the Siamese government traditionally depended, seem to have been determined largely by the physiographical conditions of the delta. Traditional wet-rice cultivation generally depended on water supply from natural inundation of river channels. Because shortages of water may result from the unstable

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monsoon rainfall pattern, rice cultivation needs supplemental irrigation from the annual floods[1]. And to use the floodwaters effectively, systems of canals have been developed in addition to the watercourses of the natural drainage system. At the same time, the natural watercourses have been important to the traditional government economy, as well as to rural society for its daily communication and economic activities[2]. The traditional economy was based primarily on control and mobilization of corvée labor, taxation, and foreign and domestic commerce. The development of the economy was accomplished by facilitation of inland navigation through construction of canal systems.

In the mid-nineteenth century A.D., the conclusion of the Bowring Treaty in 1855 had an important effect on the national economy in Thailand, involving it in international economic networks. The development of canal systems was also closely related with this economic development, since in order to meet the foreign demand for rice, rice production had to be expanded.

In his analysis of economic change since the latter half of the nineteenth century, J.C. Ingram described the development of irrigation projects which resulted in expansion of rice production[3]. In particular, he discussed the role of modern irrigation and drainage systems operated from the latter part of the fifth reign (A.D. 1890-1910). Without doubt the modern systematic projects that are based on the project submitted by Homan van der Heide were fundamentally significant in agricultural development in this period. Government efforts to carry out these projects led to the establishment of Krom Khlong, later Krom Thotnam ("Royal Irrigation Department").

Ingram also pointed out that the government had done comparatively little towards provision of public works for irrigation and reclamation of land before the introduction of these systematic projects[4]. This view of pre-modern agricultural development seems to result from the

1. Credner, 1935: p. 212; Dobby, 1958: p. 272; Pendleton, 1963: p. 138.
2. Credner, 1935: pp. 304-305.
3. Ingram, 1971: pp. 79-85.
4. *Ibid.*: pp. 80-81.

stress placed on the remarkable development in the following periods. In the pre-modern period, however, there were formative processes important for future development. These were indigenous, and closely related to the geographical and historical conditions of the Chao Phraya delta.

In addition to Ingram's economic historical analysis, there are many studies of the hydraulic works and irrigation projects in this delta, based on various disciplines. With few exceptions, however, most recent works in the field of geography and socio-economic history have tended to overlook the earlier indigenous and traditional processes[5]. The changes brought by large-scale public works in this region cannot be allotted their proper place in the development of the national economy without consideration of earlier canal construction and its aims. Useful discussions of this subject may be found in Tomosugi, Hubbard, Small and Johnston, who have investigated Thai historical materials; through their exhaustive description of hydraulic works, they have to a certain extent succeeded in indicating the effects which these projects have had on the course of Thai history[6]. However, more detailed examination is necessary to clarify the types of irrigation works undertaken and their aims, particularly for the very important latter part of the nineteenth century.

In this article, I describe the formative process of the canal systems which provided the foundations for later agricultural development, and analyze the development of two main functions of traditional canals, transportation and distribution of floodwater to adjacent ricelands, through investigation of Thai historical sources. In addition, I draw attention to the type of reclamation and land tenure brought about by a series of new canal excavations in the latter half of the nineteenth century[7].

5. Credner, 1935: pp. 215-217; Pendleton, 1962: p. 141.
6. Tomosugi, 1966: pp. 165-176; Hubbard, 1967; Small, 1973: pp. 1-24; Johnston, 1974.
7. As for the changing process of land tenure of this period, see Lingat, 1940: pp. 37-41; Tomosugi, 1967: pp. 96-105; Kitahara, 1973: pp. 11-48.

A brief but useful description of canal excavation may be found in *Rüang Prawat Krasuang Kasettrathikan* ("A History of the Ministry of Agriculture") by Čhao Phraya Wongsanupraphat, first published in 1910 A.D.[8] The description consists of short documents concerning canal excavation from Ayutthaya times until van der Heide's resignation from the directorship of Krom Khlong, most of which are cited from royal chronicles and royal decrees issued in the fourth and fifth reigns[9]. In that description, however, there are some mistakes in dates, dimensions of the canals and reclaimed land, and other details of canal construction. Thus researchers must return to the primary sources.

I have closely examined the details of canal construction in the appropriate editions of royal chronicles of the Ayutthaya and Ratanakosin periods[10]. In addition, I have also examined royal decrees and proclamations after the fourth reign concerning construction and maintenance of canals and reclamation of land adjacent to canals, which were compiled in *Prachum Kotmai Pračham Sok* ("Collected Laws, Arranged Chronologically")[11]. Other Thai sources and important documents written by contemporary Europeans have also been used. A series of topographical maps (scale 1:50,000), surveyed mostly in the 1910s and revised in the 1950s by the Division of Maps, Royal Thai Army, have also provided useful information[12].

8. Hereafter abbreviated as *PKK*.
9. *PKK*: pp. 125-161.
10. For the royal chronicles of Ayutthaya, the Luang Prasoet version (*PPKA 1*), the Krom Phra Pramanuchit version (*PPKA 2*), the Phan Čhanthanumat version (*PPKA 3*) and the Somdet Phra Phanarat version (*PPKA 4*) are used. For the royal chronicles of the Ratanakosin period, the National Library editions for each reign published by the Khlang Witthaya Press (*PPKR I,II* and *PPKR III, IV*) are used. In addition, for the fourth reign, useful information on canal excavation is found in *Rüang sathanthi lae watthu süng sang nai Ratchakan Thisi* ("Public works constructed in the fourth reign") in *Prachum Phongsawadan, phak thi 25* ("Collected Chronicles, vol. 25") abbreviated as *PP 25*.
11. Hereafter abbreviated as *PKPS*.
12. These maps are held by the Institute of Developing Economies, Tokyo, Japan.

B. Physiographical conditions of the Chao Phraya delta

1. The upper part of the delta

The upper part of the delta comprises alluvial plains that developed along the main channel of the Chao Phraya river and its distributary channels, the Suphan Buri (Tha Chin), Noi and Lop Buri, between the provinces of Chainat and Ayutthaya. According to the physiographical classification of Takaya[13], this region corresponds to the old delta area, which has a distorted, fan-shaped configuration with the apex at Chainat. The elevation is between 20 meters (m) and 5m above sea level, with the general slope in a north-south direction. The repeated bifurcation of river channels forms a network of spreading distributaries with well-developed natural levees.

Ricefields can be found along the watercourses which spread into the backswamps between natural levees. The distribution of ricefields, however, was restricted to depressional plots until the introduction of modern irrigation schemes in the early part of the twentieth century[14]. Small artificial channels that clearly were excavated can be distinguished from natural watercourses (figure 2). These small canals, which run across natural levees to backswamps, sometimes use natural watercourses or marshes. Although the date of excavation is not clear, they seem to have been excavated in order to expand ricefields that were restricted by the topography of the backswamps. On the well-developed natural levees along rivers, a continuous pattern of "ribbon settlement" predominates[15]. This is a typical component of the landscape of the old delta area. The historical towns, such as Ayutthaya, Suphan Buri, Sing Buri, Phrom Buri, Inthaburi (In Buri), and Ang Thong are also situated on natural levees along main river channels. These important towns were included in the category of "fourth-class town" *(huamüang čhattawa)*, which was directly administered by the central government from the time of the Ayutthaya kings[16].

13. Takaya, 1971: pp. 375-397.
14. *Ibid.*: pp. 384-386.
15. Sternstein, 1965: pp. 30-31.
16. Tanabe, 1972: pp. 247-251.

2. The lower part of the delta

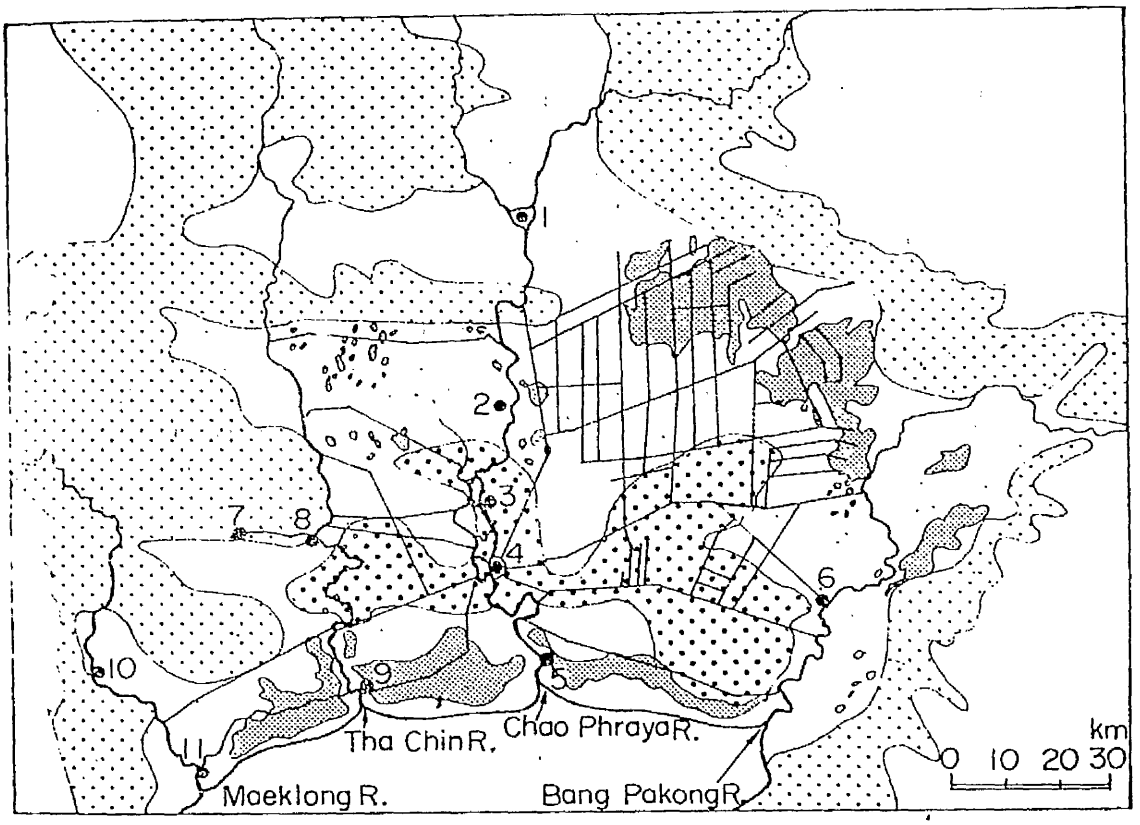
The lower part of the delta, which comprises Takaya's "deltaic high" and "delta flat" areas, is low-lying, flat terrain of elevation less than 5m above sea level, and stretches from around Ayutthaya to the Gulf of Thailand (figure 1). This region is considered the youngest plain geomorphologically, and is thought to have risen from the Gulf of Thailand during the past few thousand years[17]. The deltaic high has an average elevation of 3m, occasionally reaching 5m, and extends to Nakhon Chaisi on the west, to the area north of Nonthaburi along the Chao Phraya main channel on the north, to the southern boundary of the Rangsit canal system and the west bank of the Bang Pakong river on the east, and centers on the site of Bangkok. Takaya suggests that this elevated land may have formed on old beach ridges or on a complex of natural levees. This area has about 1m higher elevation and a higher stream density than the surrounding delta flat area. Because of these topographical conditions, which give adequate flood depth for rice cultivation and quick drainage, cultivation in this area was much more widespread than in the delta flat[18].

The delta flat is mostly low-lying land of elevation less than 2m, and almost no local relief. This recent delta is dominated by brackish environments and unstable lowland with numerous wandering marshes and swamps. Takaya describes it as an "amphibious terrain": it is neither land nor water. It covers the area between the old delta and the deltaic high including the Rangsit canal region and the coastal area[19]. Until the early part of this century, a considerable area adjacent to the coast was subject to the influence of the tide, and is still covered by hypersaline plants such as mangrove and nipa.

Settlement of the lower part of the delta is considered to be very recent. The remarkable development and expansion of Siamese settlement since the latter half of the nineteenth century were achieved through the social demand for expanded rice production, brought by the liberali-

17. Smyth, 1898: vol. I, pp. 54-55; Takaya, 1969: p. 24; Credner, 1935: p. 37.
18. Takaya, 1971: pp. 390-391.
19. *Ibid.*: pp. 387-388.

Figure 1. Physiographic regions and trunk canals in the lower part of the Chao Phraya delta



Notes: Modified from Takaya, 1971: p. 390.

1 : Ayutthaya
2 : Pathum Thani
3 : Nonthaburi
4 : Bangkok
5 : Samut Prakan
6 : Chachoengsao
7 : Nakhon Pathom
8 : Nakhon Chaisi
9 : Samut Sakhon
10 : Ratchaburi
11 : Samut Songkhram

zation of trade and a series of domestic reforms. Before that, from Ayutthaya times to the early part of the Ratanakosin dynasty, though the main towns were mostly situated at the mouths of river channels or at water-traffic centers, they were primarily ports. Vast tracts of land behind them were left uncultivated, because there were hardly any perennial means of access to the land behind towns other than the main river channels. At the same time, lack of artificial watercourses for water supply and drainage of ricefields made rice cultivation impossible[20].

In the mid-nineteenth century, canal excavation projects were started in what corresponds to Takaya's deltaic high area. The inland navigation system was gradually completed through the excavation of trunk canals, which linked the main river channels with the capital. In the delta flat area, which was largely uncultivated, canal construction was begun at the end of the nineteenth century. Thus the process of canal construction in the delta was strictly determined by physiographical conditions.

In the following sections I discuss the historical process of canal construction through detailed examination of the relevant historical sources.

C. Canal construction in the Ayutthaya and early Ratanakosin periods

1. Ayutthaya period (A.D. 1350-1767)

Throughout the Ayutthaya period, the center of agricultural production seems to have been the upper part of the delta. Although there is scant documentation of canal excavation for irrigation in this region, a large number of small, artificial watercourses which seem to have been used for irrigation can be found throughout the old delta area on topographical maps. But editions of the *Royal Chronicle of Ayutthaya*, which give information on the achievements of the central government, hardly mention irrigation canal projects. Assuming that most of those watercourses were not dug in later periods, it seems likely that excavations were carried out not as government projects but as

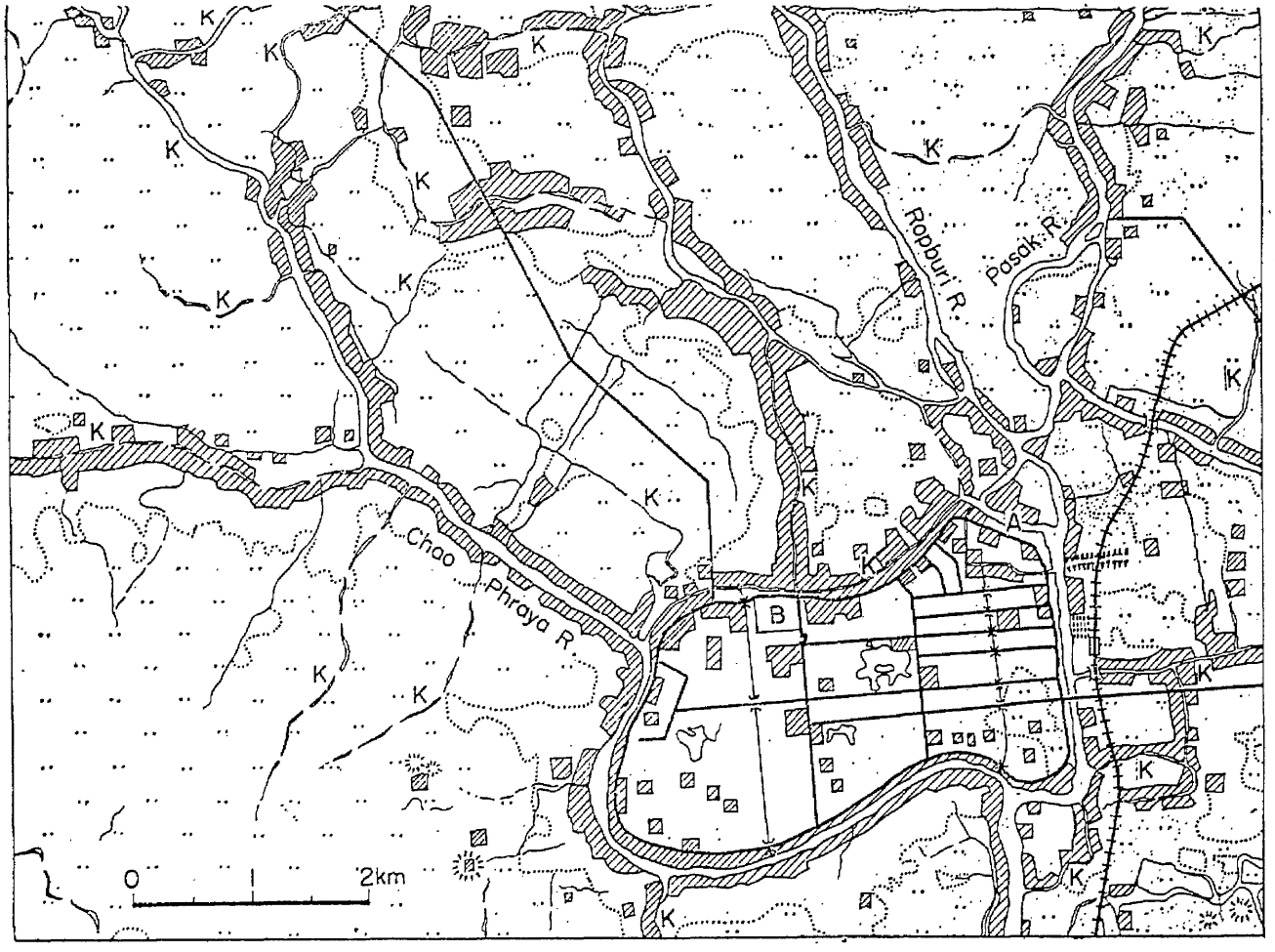
20. Bowring, 1857: vol. 1, p. 8.

community or individual works by peasants, probably during or since the Ayutthaya period[21]. Credner has also indicated the existence of networks of small, winding canals excavated by peasants in this area, in his morphogenetical analysis of plans of canals and watercourses in this delta[22]. Even if peasants in rural communities wished to dig watercourses, they could not do so without government permission. Thus *Phra Thammanun* ("Law of Procedure"; A.D. 1743) in *Kotmai Tra Sam Duang* ("The Law of Three Seals") provides as follows:

> The seal of Phra Phirun ["Rain God"] standing on the back of a king *naga* should be used in cases of scooping up water for irrigation of ricefields and for the digging of small ponds[23] [*bŭng bang*] or irrigation canals from which to draw water.[24]

This was one of the seals of the Krom Na ("Ministry of Agriculture") of this period. Thus, in the Ayutthaya period, the government seems to have made a limited effort to control irrigation works operated by peasants in rural communities. Government control over irrigation, however, was not as rigid as in the Lannathai kingdom which had a well-developed irrigation system, constructed and maintained by both government and peasants[25]. Rice cultivation in the backswamps of the old delta region did not require large-scale irrigation. Using the water supply from annual floods, peasants could get sufficient water for rice cultivation merely by digging small watercourses and ponds. Thus the government concentrated on public works for transportation of products and for military affairs, rather than for irrigation, throughout the

21. According to a personal communication from Dr. Takaya, a large number of small watercourses are the result of small-scale repairs and dredging of existing natural watercourses.
22. Credner, 1935: p. 217.
23. *Bŭng* seems to mean artificial pond, as well as marsh or swamp, in the depressional area of the delta. Bradley explains that *bŭng* means a large *khlong* without streams in barren land, while *bŭng bang* means a smaller one. (Bradley, 1873: p. 360.)
24. *Kotmai Tra Sam Duang* ("The Law of Three Seals") is abbreviated to *KTS*: vol. 1, pp. 147-148.
25. Kraisi, 1965: pp. 10-14; Tanabe, 1975: pp. 79-82.



River channel or canal
Road
Railway
Village, including ruins
Rice fields
A The Khuna canal
B Old palace
K Channel, named Khlong on the topographical map

Note: Taken from the Ayutthaya sheet of the topographical maps surveyed in 1915 by the Division of Maps, Royal Thai Army, and revised in 1953. Scale: 1:50,000.

Ayutthaya and the early Ratanakosin periods[26]. Apart from irrigation canals, three other types of canal may be distinguished according to function and form: the city moat, the short-cut *(khlong lat)*, and the transverse canal. In addition, it is possible to argue that most of those canals were constructed as government public works under the king's orders, usually using corvée labour *(phrai)* under the supervision of a chief director *(mae kong)* who was appointed from among high-ranking noble officials. (See figure 2.)

City moat canals. When the capital was founded at Ayutthaya in A.D. 1350, a city moat and fortifications had already been constructed near the confluence of three rivers; the Chao Phraya, Lop Buri and Pasak[27]. At least two later descriptions concerning construction of a city moat on the east, which may correspond to the Khüna canal of the end of the sixteenth century, can be found in the royal chronicles[28]. As shown by Phraya Boranratchathanin and Sumet Jumsai's reconstruction of the old city plan, a complicated but splendid network of canals facilitated communication between political and religious centers, markets and settlements, both inside and outside the city[29]. The city moats might have also been used for domestic water supply in the dry season. It should be noted that the remains of an old barrage to hold water in the dry season was discovered at the mouth of a canal inside the city[30].

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26. Čharubut, 1972: p. 564; Phonipha & Thawisin, 1975: pp. 46-47. During the Ayutthaya period, governmental control over irrigation works is hardly mentioned in historical materials. In Phra Ayakan Betset, clauses 28, 29 and 30 of *Kotmai Tra Sam Duang*, one finds only provisions for punishment, with a fine, in cases of stealing water. (*KTS*: vol. 2, p. 209.)
27. Boranratchathanin, 1963: p. 6, footnote 2; Sternstein, 1965a: pp. 88-90; 1966b: pp. 221-220.
28. In the Luang Prasoet version, L.E. 942 (A.D. 1580) is given, while L.E. 932 (A.D. 1570) is given in the Phan Čhanthanumat version. (*PPKA 1*: vol. 1, p. 151; *PPKA 3*: p. 134). Although W.A.R. Wood mentions the reconstruction of the city wall in A.D. 1550 in King Čhakraphat's reign, no information is given for the city moat. (Wood, 1926: p. 114.)
29. Sumet, 1970: pp. 301-314.
30. Boranratchathanin, 1969: pp. 43-44.

But the two primary functions of the city moats were military and transportation. Thus the moat was usually accompanied by ramparts and fortifications, as in the towns throughout the upper delta such as Suphan Buri, Lop Buri and Sara Buri[31].

Short-cut canals. From the sixteenth century, in accordance with the development of foreign and domestic trade, the maritime ports and towns along the lower reaches of river channels became increasingly important centers of transportation. The main channel of the Chao Phraya river also assumed the important function of the trunk navigation route linking the capital with the Gulf of Thailand. In order to improve and shorten the route, the government carried out short-cut canal projects. Such projects accounted for the greater part of public works, and at least ten were carried out on a vast scale. According to the rooal chronicles, the short-cut canals were largely restricted to meandering parts of the channel between Pathum Thani to the north and Phra Pradaeng (Nakhon Khüankhan) to the south.

Besides Thai historical sources, navigation charts drawn by contemporary Europeans, such as the chart held in the General State Archives at the Hague[32], also show re-channelization under such projects. Table 1 lists these navigation charts. Figure 3 is a map showing the courses of short-cut canals and old transverse canals excavated during the Ayutthaya period.

Below appears the example of the Tret Noi canal from the Pramanuchit version of the royal chronicle:

> In the Year of the Tiger, the fourth year, the King thought that as the meanders near the mouth of the Bang Buathong canal were very tortuous, a short-cut should be constructed. The King thus ordered Phra Thonburi, the chief director, to conscript around ten thousand corvée laborers from the southern provinces to excavate the Tret Noi canal, 6 *sok* [3m] deep, 6

31. For example, construction of city moats in Lop Buri in the reign of King Narai. (*PPKA 2*: vol. 2, p. 95.)

32. Detailed information on this chart is given in Meilink-Roelofz, 1965: pp. 167-184.

Table I.

Navigation charts of the lower part of the Chao Phraya river.

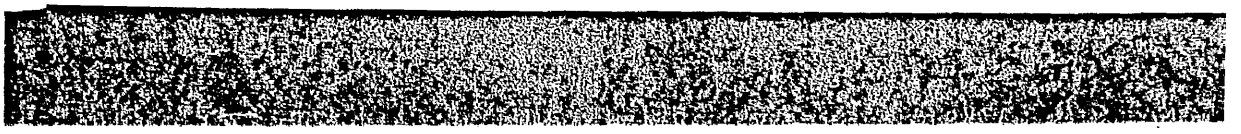
I. "Kaart van de Rivier van Siam, van de Zee tot aan Stad Siam ofte Judea", circa 1687/8 A.D. (Loeupe No. 267, General State Archives, The Hague), a facsimile of which is in the Siam Society's map collection.

II. de la Mare, "Carte du cours de Më-nam depuis Siam jusqu' à la mer copiée en petit d'après une fort grande faite par M. de la Mare ingénieur du Roi", no date, in Lucien Fournereau, "Le Siam ancien", *Annales du Musée Guimet*, vol. 20, Paris, 1895.

III. La Loubère, "Carte du cours du Menam depuis Siam jusqu' à la mer, copiée en petit d'après une fort grande faite par M. de la Mare, ingénieur du Roy", in his *Du Royaume de Siam*, vol. 1, Amsterdam, 1691.

IV. François Valentyn, "De Groote Siamse Rievier Me-Nam ofte Moeder der Wateren in haren loop met de in vallende Spruyten Verbeeld", in his *Beschryving van Oud en Niew Oost-Indiën*, vol. III, p. II, no. 35, Dordrecht, 1726.

V. Engelbertus Kaempfer, "Mspps Meinam Fluvij, ad orig. Eng. Kaempfer delin I.G.S.", in his book translated by Scheuzer, *The History of Japan, together with a Description of the Kingdom of Siam*, vol. 1, London, 1727.



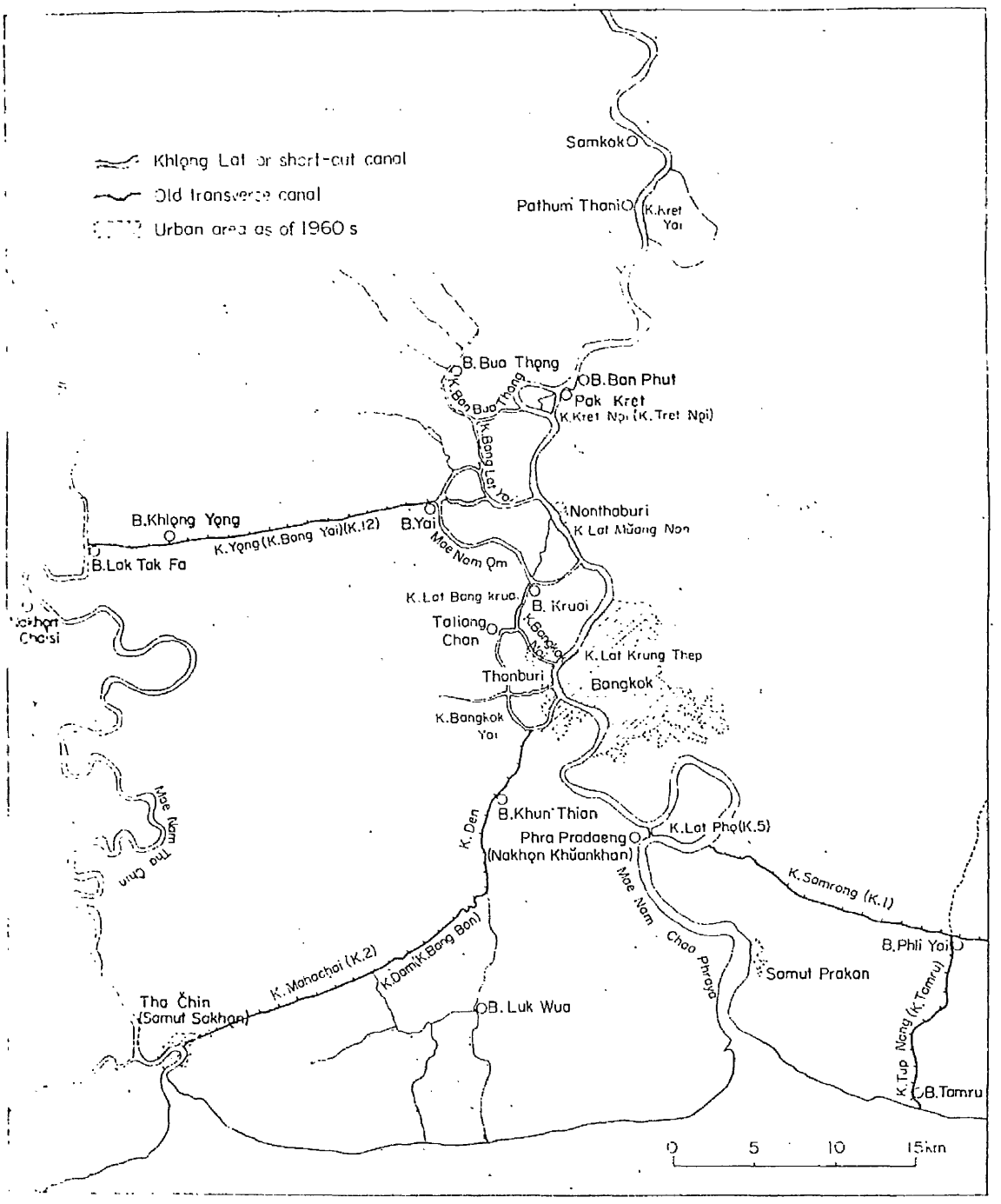
wa [12m] wide and 29 *sen* [1,160m] long. Then Phra Thonburi undertook the King's order, and completed excavation in about one month, within the same year[33].

The Year of the Tiger, the fourth year, corresponds to Chunlasakharat 1084 (L.E. 1084=A.D. 1722/3). But on the navigation chart of A.D. 1687/8 in The Hague, and on Kaempfer's and La Loubère's charts, this canal appears as completed. In addition, the topographical map of the 1910s and this writer's field research show that the dimensions of the Tret Noi canal correspond exactly with those given in the chronicle[34]. So, although this description refers to the Tret Noi canal, other evidence suggests that the date of excavation is incorrect, and should be set before A.D. 1687. However, no other description concerning this project can be found in the chronicles. Prince Damrong and the author of *A History of Nakhon Khïankhan* pointed out this discrepancy, asserting that the description must relate to the Lat Pho canal located near the southern town of Phra Pradaeng[35]. But, because the description in the chronicle does not fit the Lat Pho canal, but does fit the Tret Noi canal, the claim is not well founded. The date of excavation therefore remains obscure. The "southern provinces" may indicate the fourth-class provinces *(mïang čhattawa)* situated south of the capital. Large numbers of corvée laborers living in nearby provinces were ordinarily conscripted for canal excavation.

As the construction of short-cut canals frequently caused shifting of main channels, the network of the Chao Phraya between Pathum Thani and Phra Pradaeng has been largely transformed, as shown in figure 3. The network of old channels, tributaries, distributaries and artificial short-cut canals made up a comprehensive system of water transportation between the two towns. With the development of transportation in the lower delta region from the mid-nineteenth century, this canal system was important in linking the many trunk canals constructed to the east and west of the Chao Phraya with the capital, Bangkok.

33. *PPKA 2*: vol. 2, p. 219. In a recently published edition of the Somdet Phra Phanarat version, "Kret Noi" is given in place of "Tret Noi". (*PPKA 4*: p. 595.) The year L.E. 1048 given in *PKK* could be a misprint. (*PKK*: p. 130.)
34. See the Čhangwat Nonthaburi sheet, 459/4-47.
35. Sang, 1958: pp. 11-12.

Figure 3. Short-cut canals and old transverse canals of the Ayutthaya period



Transverse canals. The dynastic chronicle cites two examples of transverse canals constructed for the main purpose of water transportation. These are the Samrong canal, which runs from the east bank of the Chao Phraya toward the Bang Pakong river, and the Mahachai canal, which runs transversely from the west bank to the mouth of Tha Chin river. Both canals were built across the barren coastal area, which was sparsely populated in that period[36].

According to the chronicle, the Samrong and Thap Nang canals to the southeast of Bangkok were already in existence in L.E. 860 (A.D. 1498), during the reign of Ramathibodi II, that is, the early Ayutthaya period. In this year, because of the inconvenience to navigation caused by deposition of silt, the king ordered the improvement of the two canals[37]. The pattern of channels on topographical maps suggests existing natural channels between the Chao Phraya and the Bang Pakong, and that the Samrong canal was built to link these natural channels. As there is no other information about this canal, it is not clear when it was constructed.

For the Mahachai canal in the west, information is available on its excavation and the reasons why it was built. This canal, in contrast to the Samrong canal, was constructed as a straight channel. In L.E. 1066 (A.D. 1704) the chronicle records as follows:

> The King, Prabat Boromabophit Phra Phuttha Čhaoyuhua [Phra Phuttha Čhao Süa], thought that the Khok Kham [Mahachai] canal was so tortuous that it was troublesome for people to row their boats along it. Their route is long and circuitous. So the meandering parts should be made straight. Then the King ordered the Samuha Nayok ["Minister of Civil Affairs"] to conscript thirty thousand corvée laborers from the provinces to excavate the Khok Kham canal, to straighten it and make it 6 *sok* [3m] deep, 8 *wa* [16m] wide at the top and 5 *wa* [10m] wide at the bottom. He also appointed Phra Ratchasongkhram as chief director, in command of all provincial corvée labor, and responsible for completion of the canal excavation in accordance with the King's order[38].

36. La Loubère, 1691: tome 1, pp. 7-8.
37. *PPKA 2*: vol. 1, p. 48.
38. *Ibid.*: vol. 2, p. 204.

The chronicle also relates how the king told high-ranking noble officials of the glorious achievements in canal construction by former kings, from King Ramathibodi II's construction of the Samrong canal in A.D. 1498 to King Prasat Thong's Nonthaburi short-cut canal constructed in A.D. 1636[39]. He then solemnly declared that he would complete this work. The corvée labor commanded by Phra Ratchasongkram was mobilized from eight provinces in the lower part of the delta, that is, Nonthaburi, Thon Buri, Nakhon Chaisi, Sakhonburi, Samut Songkhram, Phetchaburi, Ratchaburi and Samut Prakan. It appears that scientific survey methods introduced by Europeans were used for the first time in large-scale canal construction in Thailand. Phra Ratchasongkhram ordered the measurement of the projected route of 340 *sen*, or 13.6 kilometers (km), with surveying instruments, and he himself took charge of part of the excavation[40]. Construction began in the next year, A.D. 1705, but remained unfinished because of the death of the king, Phra Phuttha Chao Süa. It was not until more than ten years later, in the reign of King Thai Sa (L.E. 1083, or A.D. 1721), that it reached the mouth of the Tha Chin river, by mobilizing 30,000 corvée laborers[41].

The straight part of this long transverse canal seems to have been achieved by dextrously straightening some winding distributary channels (fig. 4). Even on a topographical map of the 1910s, it passed through spacious barren terrain with brackish vegetation[42]. As with other canals of the Ayutthaya period, this suggests that the canal was not excavated for improvement of agricultural production, but for inland navigation in the coastal provinces, and south to the Malay Peninsula.

These two transverse canals, which allowed traffic to move from the Chao Phraya trunk channel to the mouths of the two parallel main channels to the east and west, contributed to the development of communication facilities, especially to and from coastal provinces and the capital. Thus the government of Ayutthaya seems to have primarily

39. *Ibid.*: vol. 2, p. 205.
40. *Ibid.*: vol. 2, pp. 204-206.
41. *Ibid.*: vol. 2, pp. 218-219.
42. See the Samut Sakhon sheet, 530/4-47 and the Ban Hua Krabu sheet, 531/4-47.

intended to secure transportation facilities for movement of corvée labor and, through expansion of the canal system south of the capital, to encourage foreign trade, which is important in explaining the vigor of the Ayutthaya administration.

2. *The early Ratanakosin period (A.D. 1782-1851)*

There was no marked development of canal construction in the early Ratanakosin period, especially during the reign of Rama I and Rama II. City moats which contributed to the defence of the capital, and some short-cut canals for navigation, were constructed continuously. In the early Ratanakosin period, canal construction consistently followed the Ayutthaya tradition.

City moat canals. The excavation of the Rop Krung canal as an eastern city moat by conscripted Cambodian captives in L.E. 1145 (A.D. 1783), and the construction of a moat-fortified city similar in form and function to Ayutthaya, are mentioned in *The Dynastic Chronicle of the Ratanakosin Era, Rama I*[43]. The city plan of the new capital seems to have been significantly influenced by the old capital of Ayutthaya. The chronicle records that:

> The King ordered the excavation of a large canal to the north of Wat Saket, named the Mahanak canal. This canal was excavated so that the city people could assemble, in boats, to perform music and to recite poetry as in the rainy season ceremony of the old capital, Ayutthaya[44].

Although generally considered as a route for traffic to and from the eastern region from the fortified city area, it is noteworthy that the Ratanakosin dynasty's desire to restore the glory of old Ayutthaya was reflected in plans for canal construction in this period.

Short-cut canals. The removal of the core of the kingdom to a more maritime location, with the establishment of the new capital at the lower part of the delta, meant that the short-cut canals dug in the Ayutthaya period were greatly utilized. But unexpected problems were also encountered because of those canals. For instance, the Lat Pho canal which was excavated to avoid a large meander south of Bangkok,

43. *PPKR I, II*: p. 68.
44. *Ibid.*: p. 68.

had been gradually widened by high tides, allowing seawater to penetrate farther inland and causing widespread damage to ricefields near the capital at times of flooding. Rama I therefore ordered that bricks brought from the ruins of Ayutthaya be used to construct a barrage to hold back the tidal water, in L.E. 1146 (A.D. 1784)[45].

Changes in canal development. It seems to have been during the reign of Rama III that changes took place in canal construction, which had previously been the same as that of the Ayutthaya period. Firstly, canal construction became more closely related to military affairs. Secondly, with the proliferation of taxation of farming, and the pervasion of payment in specie instead of performing corvée, a change was effected in the labor used in canal construction. Chinese wage labor, which was cheap and reliable, was widely used as a substitute for unreliable Thai corvée labor under the disorganized process of traditional conscription[46].

The military role of river channels and canals in moving troops and supplies needs to be stressed[47]. In this period, with conflicts with Burma, and later with the British in the Malay Peninsula, with Annam over Cambodia, and the problem of establishing sovereignty over the Laotian principalities of the Khorat Plateau and the middle reaches of the Maekhong river, rapid conveyance of troops and supplies was the main consideration. At the same time, in order to meet this heavy military expenditure, the securing of transportation facilities for collection of various taxes and the requisition of goods was also necessary[48]. Because of these military and revenue requirements, the reinforcement of the defense of the mouths of rivers or the existing main canals near the capital, and the maintenance and construction of transverse canals linking the main parallel channels, were regarded as important during this period.

Maritime ports, called *huamüang pak nam* ("fortified rivermouth town"), which occupied strategic points at the mouths of the rivers Chao Phraya, Tha Chin and Maeklong, had performed an important function

45. *Ibid.*: pp. 79-80.
46. Ishii, 1968: pp. 51-52.
47. Wales, 1965: pp. 229-230.
48. Vella, 1957: p. 24.

as centers of trade under the jurisdiction of the Krom Tha ("Harbor Department") since the Ayutthaya period. These towns also functioned as fortified towns with garrison troops. Phra Pradaeng was typical of such a fortified town at the beginning of the Ayutthaya period. Later, in the reign of King Songtham at the beginning of the seventeenth century, Phra Pradaeng was abandoned because of regress of the shoreline caused by deposition of sediment at the mouth of the Chao Phraya river, and Samut Prakan was established farther south on the east bank.

From L.E. 1176 to 1178 (A.D. 1814-1816), Rama II ordered the establishment of a new fortified town, Nakhon Khüankhan, on the opposite bank to old Phra Pradaeng, between Samut Prakan and the capital, where 300 Mon conscripts from the old Mon settlement of Pathum Thani were settled as garrison troops[49]. There is a description of fort construction at Samut Prakan in L.E. 1181 (A.D. 1819)[50].

Although these forts were located at strategic points along the Chao Phraya main channel for the defense of the capital, they were also gradually established at the junction of the existing canals. In B.E. 2372 (A.D. 1829) immediately after the rebellion of Čhao Anu was crushed, the chronicle of the reign of Rama III reads as follows:

> The King ordered Phraya Chodükratchasetthi (Thong Čhin) to erect a fort, later named the Wichian Chodük fort, at the junction of the Mahachai canal at Sakhonburi. The wages of the Chinese for brickwork were 47 *chang*, 15 *tamlüng*, 3 *baht*, 2 *salüng*, 1 *füang* [3,823.625 baht]. Then the King ordered the Mon clan under the command of Čhao Phraya Mahayotha to live in the town of Sakhonburi.[51]

Sakhonburi functioned as a traffic junction for the Tha Chin river and the Mahachai canal. It is important to note that the chief director of construction seems to have been descended from a Chinese noble, and that many Chinese wage laborers were hired. This appears to be the first example of Chinese wage labor being hired for large-scale public

49. *PPKR I, II*: p. 505.
50. *Ibid.*: p. 692.
51. *PPKR III, IV*: p. 92.

works in the dynastic chronicles[52]. Thereafter construction or improvement of canals was mostly carried out by Chinese wage labor rather than corvée labor.

The chronicle next relates the construction of the Sunak Hon canal (fig. 4), a long transverse canal, running through the coastal delta-flat region to the mouth of the Maeklong river, and linked with the Mahachai canal at Sakhonburi :

> The King named Čhao Phraya Phra Khlang ["Minister of Finance"] chief director of excavations for the Sunak Hon canal. Čhao Phraya Khlang discovered that the currents which met at the straight section made it shallow, and considered that if a lateral canal were dug flowing into the point where the currents met, it would remain at the required depth. He hired Chinese wage labor to excavate a lateral canal from the Sunak Hon canal to the meadow at Pho Hak village. And then he conscripted water buffaloes and peasants to wade through the canal. So the water flows swiftly and the canal keeps its depth to this day. The wages of the Chinese for excavation were 102 *chang*, 4 *tamlüng*, 1 *salüng*, 1 *füang* [8,176.375 baht][53].

The Sunak Hon canal seems to have consisted of two natural distributary channels parallel to the coastline. The description suggests that tidal currents, which came upstream from both the Tha Chin and the Maeklong rivers at high tide, met at the center of this canal and deposited thick silt sediments[54]. The deposition of silt sediments often occurred in canals in the lower part of the delta, even in later periods, and it was necessary for the government to carry out frequent repairs. In the Sunak Hon canal, the construction of a drainage canal to take the

52. As an early example of public works carried out by Chinese wage labor, Skinner mentions the funeral ceremony of King Rama II in A.D. 1824. (Skinner, 1957: p. 114.) The royal chronicle of the fourth reign mentions excavation of a short-cut canal behind the town of Nakhon Khüankhan by Chinese wage labor during the second reign. But we cannot find any evidence of this in Prince Damrong's edition of the royal chronicle of the second reign. *PPKR III, IV*: p. 436; *PPKR I, II*: p. 693.

53. *PPKR III, IV*: pp. 92-93.

54. Mgr. Pallegoix who travelled this canal from the Mahachai canal via Sakhonburi in A.D. 1843, describes its channel as running tortuously to the west and its water as brackish. (Pallegoix, 1854: tome 1, p. 98.)

tidal current at high tide was carried out, and the silt sediment on the bottom of the canal was stirred up by water buffaloes and washed out.

Besides the technical importance of this canal improvement, it has a wider significance because the Sunak Hon canal, together with the Mahachai canal, opened artificial navigation routes between the three main river channels, the Chao Phraya, Tha Chin and Maeklong. The *huamüang pak nam*, such as Sakhonburi and Samut Songkhram, stood at the junctions of rivers, running from north to south, and the transverse canal routes. At this period, after the British victory in the first Anglo-Burmese War, and with tension about sovereignty over the Malay sultanates, this westward canal route seems to have been of special significance in military affairs.

Conflict with Annam over Cambodia encouraged canal construction eastward from the capital. Thus the famous transverse Saen Saep canal, the eastern part of which is called the Bang Khanak canal, and which extended to the Prachin Buri river, the middle part of the Bang Pakong river, was excavated in L.E. 1199 (A.D. 1837)[55]. Construction of this canal aimed at hastening the movement of troops and military supplies to Cambodian territory, and took three years for a distance of 1,337 *sen* 19 *wa* 2 *sok* (53.519 km)[56]. This canal, running in a straight line on the deltaic high region to the east of the capital, facilitated exploitation of the lower part of the delta region and functioned as a main trunk canal in the following period[57].

Most canal construction undertaken to secure the flow of revenue and to facilitate military affairs in the early Ratanakosin period, is of little consequence to either the development of agricultural production or the expansion of a commercial economy. Although they had little direct connection with agricultural development when constructed, these transverse canals, which connected with the parallel river channels in the lower delta region, provided a basic network of canals for agricultural development in the following period.

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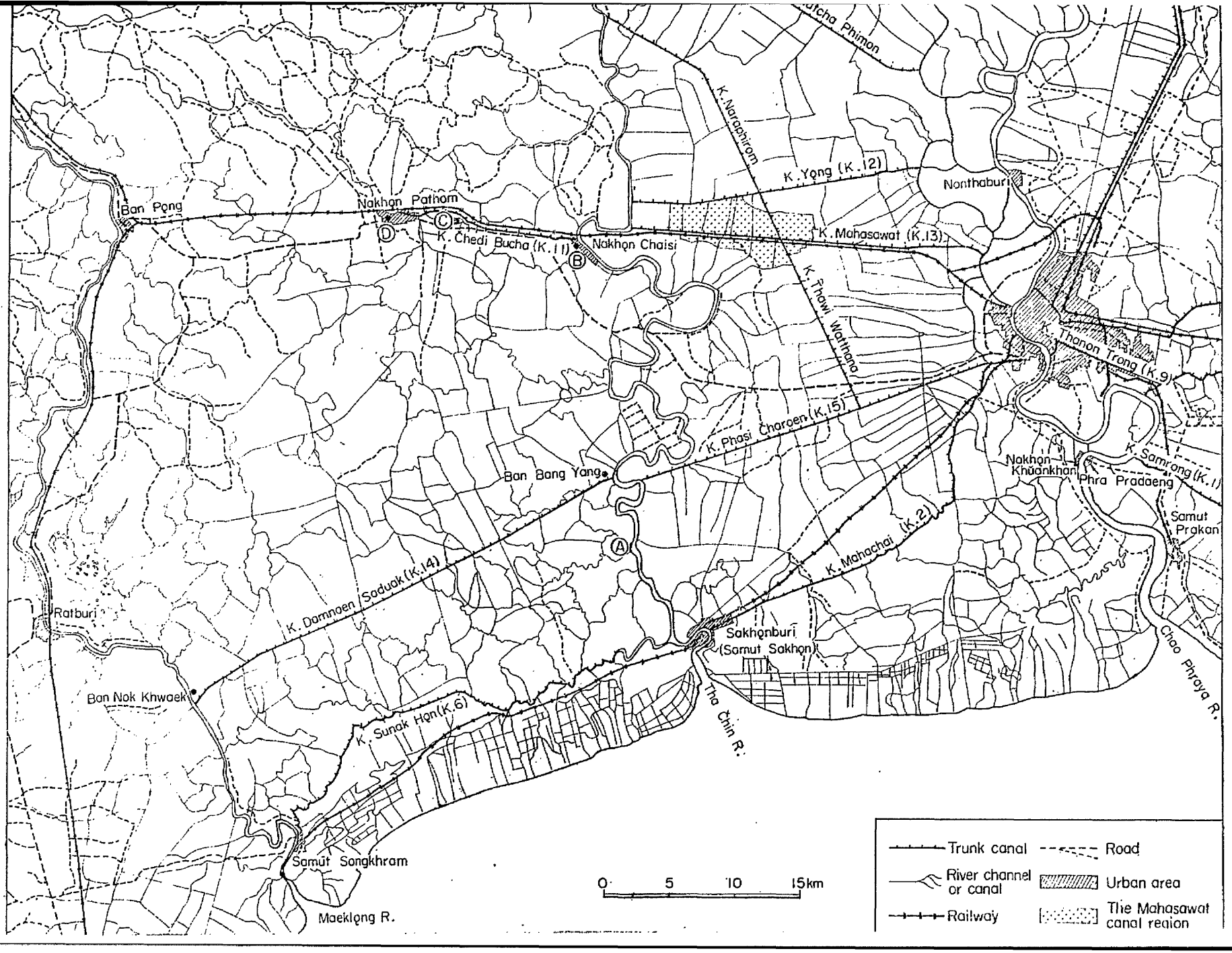
55. *PPKR III, IV*: p. 179.
56. *PKK*: p. 133.
57. Muslim Malay immigrants or *Khaek Malayu* from Müang Sai (Kedah) began to settle along this canal after the military expedition during the third reign. (Čhunlachomklao, 1933: p. 8.)


K. Naraphirom
K. Yong (K.12)
Nonthaburi
Ban Pong
Nakhon Pathom
K. Chedi Bucha (K.11)
Nakhon Chaisi
K. Mahasawat (K.13)
K. Thawi Watthana
K. Thanon Trong (K.9)
K. Phasi Charoen (K.15)
Ban Bang Yang
Nakhon Khuankhan
Phra Pradaeng
K. Samrong (K.1)
Samut Prakan
K. Mahachai (K.2)
K. Damnoen Saduak (K.14)
Ratburi
Sakhonburi (Samut Sakhon)
Chao Phraya R.
Ban Nok Khwaek
K. Sunak Hon (K.6)
Tha Chin R.
Samut Songkhram
Maeklong R.
0 5 10 15km
Trunk canal
Road
River channel or canal
Urban area
Railway
The Mahasawat canal region

D. Canal development in the mid-nineteenth century

1. Changes in Bangkok

The liberalization of trade under the terms of the Bowring Treaty, A.D. 1855, afforded an opportunity for the development of the Thai national economy in the following period. The landscape of Bangkok changed rapidly, from a military, moat-fortified city with the palace as its center, to a commercial city, interested in foreign trade with the Western colonial powers as liberal trade, rather than the former royal monopoly. The plan of Bangkok, however, had developed before the political and economic impact of Western colonial powers was felt. In canal development, the expansion of city area through the excavation of an outer city moat under population pressure in the mid-nineteenth century should be noted.

In B.E. 2394 (A.D. 1851) soon after his accession, Rama IV reflected on the achievement of the kings of the Ratanakosin era as follows:

> The previous three kings ordered canals to be excavated for the people's benefit. In these days, as the nation has attained prosperity and the population of the capital has increased greatly, the city area should be expanded[58]. The population of common people has become much larger. Houses and residences of officials and common people are mostly outside the city area[59].

The Phadung Krung Kasem canal as an outer city moat, 137 *sen* 10 *wa* (5.5 km) long, was excavated over three years. The city area was doubled, although the pattern remained the same. It is generally considered that the concentration of population in the city was chiefly caused by Chinese immigration. Table 2 shows the Chinese population of Bangkok from the beginning to the middle of the nineteenth century. The Chinese population comprised about half the total, and reached 62 per cent in 1822. In the 1850s it was more than 50 per cent of a total population of more than 300,000. The Chinese population was in a

58. *PPKR III, IV*: p. 437.

59. *Ibid.*: p. 453.

Table 2.

The Chinese population of Bangkok

Year	Chinese population	Total population	Percentage
1822	31,000	50,000	62
1826	60,700	134,000	45
1839	60,000	100,000	60
1843	70,000	350,000	20
1849	81,000	160,154	50.6
1854	200,000	404,000	49.5
1855	200,000	300,000	66.6

Sources:

1. J. Crawfurd, *Journal of an Embassy from the Governor-General of India to the Courts of Siam and Cochin-China* (London, 1828), p. 450.
2. D.E. Malloch, *Siam: Some General Remarks on its Productions* (Calcutta, 1852), p. 70.
3. H. Malcom, *Travels in South-Eastern Asia, Embracing Hindustan, Malaya, Siam and China, with Notice of Numerous Missionary Stations, and a Full Account of the Burman Empire*, vol. 1 (London, 1839), p. 139.
4. F.A. Neal, *Narrative of a Residence in Siam* (London, 1852), p. 29.
5. D.E. Malloch, *Siam: Some General Remarks*, p. 70.
6. Mgr. Pallegoix, *Description du Royaume Thai ou Siam*, vol. 1 (Paris, 1854), p. 60.
7. Sir John Bowring, *The Kingdom and People of Siam*, vol. 1 (London, 1857), pp. 85, 394.

majority of 5 : 3 according to Mgr. Pallegoix, in 1854[60]. Malloch's figures for 1826 and 1849 may be regarded as an approximate estimate of population within the old urban area surrounded by the Rop Krung canal. The Chinese population increased by 33 per cent from 60,700 to 81,000, while the Siamese population increased by only 4 per cent from 48,000 to 50,000, in 23 years[61].

These Chinese, in the majority in the urban area, operated rice mills, shops and manufacturing industries, and not only developed a commercial economy in place of the Siamese corvée peasants, who were prohibited from moving under the traditional client-patron relationship, but also met the heavy demand for labor for the government's public works[62]. The liberalization of trade made this tendency more pronounced.

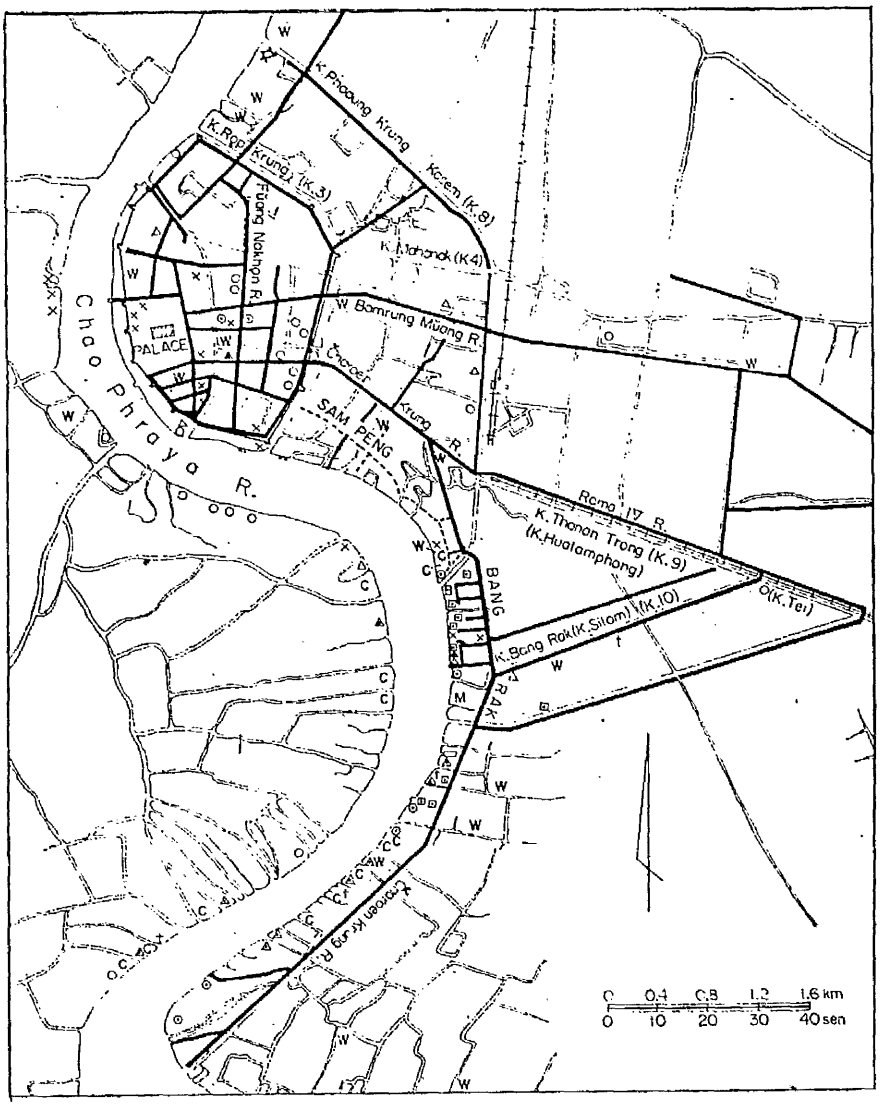
The liberalization of trade and political pressure from Western colonial powers caused a sudden change in the landscape of Bangkok. It also had an effect on canal construction in the city proper and the suburbs. For the period immediately after the conclusion of the Bowring Treaty, the chronicle reads as follows :

> In the Year of the Small Snake, consuls and business executives of foreign countries submitted a joint letter as follows. Merchant vessels must go enormous distances to reach Bangkok. In the rainy season, because of the strong current, a ship must waste many days before reaching Bangkok. Let our commercial establishments move to the south of the mouth of the Phra Khanong canal in Bang Na District. And we ask that a short-cut canal be excavated from Bang Na District to the Phadung Krung Kasem canal[63].

Accepting this request of the Western trading companies that occupied the east bank of the Chao Phraya river to move far to the south, on the grounds that conflict with foreigners should be avoided, the king ordered the excavation of the Thanon Trong canal, 207 *sen* (8.28

60. Pallegoix estimates the population as follows: Chinese who pay poll tax (200,000), Siamese (120,000), Cochin-Chinese and Annamese (12,000), Cambodian (10,000), Peguan [Mon] (15,000), Laotian (25,000), Burmese (3,000), Malayan (15,000), foreign Christian (4,000); total=404,000. (Pallegoix, 1854: tome 1, pp. 60-61.)
61. Malloch, 1852: p. 70.
62. Skinner, 1957: pp. 115-118.
63. *PPKR III, IV*: pp. 533-534; Thepchu, 1975: p. 68.

Figure 5. Plan of Bangkok, around A.D. 1900



This map is modified from the original by J. McCarthy (A.D. 1900), and therefore does not necessarily reflect the city as it was at the middle of the nineteenth century. In particular, the railway and many of the businesses, warehouses, etc. developed along the Chao Phraya from the Bang Rak area, and date from the fifth reign, or the close of the nineteenth century. However, the city skeleton of canals, river channels and roads developed from the middle of the nineteenth century.

km) long, and also the construction of a road along its north bank. This was the first case of large-scale road construction in response to foreign wishes. The canal corresponds to the Hualamphong or Toei canal, and the road on the north bank later became the Phra Rama IV Road. Nevertheless it seems that the foreigners did not move to the south but remained where they were[64]. A few years later, in B.E. 2404 (A.D. 1861) the Western consuls complained of ill health because there were no roads for their horse-drawn coaches, and put pressure on the government to construct a road system in the capital[65]. Under this pressure the king decided to initiate road construction on a large scale. A road system, including Charoen Krung Road was constructed, also called "New Road", which extends from the inner city area through Bang Rak District where foreign consulates, trading companies and residences were mostly located, as the main road. Road construction was usually undertaken in parallel with canal excavation. For example, in the case of the Bang Rak (Silom) canal, the mud which was dug out from the canal trench was used for the road. At the same time, bridges were built over many canals, and a city plan based on a road system was gradually consolidated[66]. In particular Bang Rak District, south of the Phadung Krung Kasem canal, where Charoen Krung Road is parallel and close to the Chao Phraya channel, had both water and road transport facilities. In this district, the consulates and residences of foreigners, a harbor, docks, rice mills, sawmills, warehouses and churches were located in the narrow area between the river channel and the road. Thus the traditional city plan of Bangkok, which had consisted of city moats and a complicated network of canals, underwent a marked change, its landscape being colored by colonial buildings[67]. (See figure 5.)

64. *PPKR III, IV*: p. 534.
65. *Ibid.*: pp. 601-603; *PP 25*: p. 287; Thepchu, 1975: pp. 69-78.
66. Bamrung Muang Road, Füang Nakhon Road, and part of Charoen Krung Road constructed inside the Phadung Krung Kasem canal, complemented existing canals and were important to commercial communication. (Phlainoi, 1960: p. 163.)
67. McGee, 1967: pp. 72-74.

2. Construction of trunk canals in the lower part of the delta

It is generally thought that in order to meet the demand for rice with the development of foreign trade, the government tried to increase rice production by expanding rice-growing to uncultivated wasteland in the lower delta region. However, it is not always clear where such agricultural development was undertaken, and how it was attained. Canal construction in this period is closely related to the expansion of ricelands.

In general, the government undertook canal construction to secure transportation facilities for the circulation of products, and also to expand irrigated riceland and to promote reclamation by peasants. A series of policies for encouragement of reclamation, including a policy of low land taxes for newly cultivated land, seems to have contributed to the expansion of riceland along newly excavated canals in this region[68]. Although the above suggests the basic course of agricultural development during Rama IV's reign, the regional development of canal construction in modern Thai history deserves more than passing consideration. In this section, I discuss the formation of the canal system by investigation of some examples of canal excavation.

Since the conclusion of the Bowring Treaty, which led to a steady increase in rice exports, cultivation of rice as a cash crop has gradually extended to the lower delta. Canals in this region had to irrigate the land, although they merely functioned as inundation canals which were able to send floodwater to riceland only during the rainy season. In the 1850s and 1860s, canal construction in some regions seems to have been closely related to the transportation of cash crops such as sugarcane. Sugarcane, as a dry-season crop, was cultivated only in comparatively dry areas, from Nakhon Chaisi to Nakhon Pathom in the west and Chachoengsao Province in the east[69]. This area corresponds with the deltaic high, the old delta and the fan-terrace complex area.

68. Ingram, 1971: pp. 75-83.

69. Sugarcane is not cultivated under extended inundation, but grows well in somewhat drier areas, such as the margins of the delta. (van der Heide, 1903; pp. 52-53; Credner, 1935: pp. 239-240.)

Although it is usually thought that the cultivation of sugarcane was introduced to Thailand in the 1810s by overseas Chinese from Taechew[70], sugar plantations and factories with 200 to 300 Chinese laborers were already established in Nakhon Chaisi Province in the reign of Rama III[71]. Of the exports listed by Malloch[72], sugar and sugar products were the largest, amounting in value to about 708,000 baht around 1850, and throughout the 1850s and 1860s they were among the principal exports of Thailand[73]. Floods and water shortages in Nakhon Chaisi Province in the 1870s, and the decline in the market price caused by the production of cheaper sugar in Java, brought about a rapid decline in sugarcane cultivation in those provinces[74].

A small-scale, short-cut canal construction project for transporting sugarcane is found in the chronicle as follows:

> There is a small canal at Lat Krut, which was first excavated, in order to transport sugarcane, by Chinese people in the reign of Phrabat Somdet Phra Nang Klao Čhaoyuhùa [Rama III]. These days the current has eroded it until it is as wide as the main channel [the Tha Chin river][75].

This canal, point A on the topographical map (fig. 4), was intended to shorten the route from sugarcane plantations along the Tha Chin river by way of Sakhonburi to the capital. This route (Nakhon Chaisi–Tha

70. Crawfurd suggests that introduction of sugarcane cultivation by Chinese does not date back more than 12 years from his visit to Siam (A.D. 1822). The cultivated areas in that period, he indicates, were Nakhon Chaisi and Chachoengsao Province along the Bang Pakong river. (Crawfurd, 1828: p. 112; Skinner, 1957: p. 112.)

71. Pallegoix, 1854: tome 1, pp. 101-102; Neal, 1852: pp. 68-69.

72. Malloch, 1852: pp. 46-47.

73. According to Finlayson, sugar products in A.D. 1821 amounted to 30,000 *picul* (1 *picul* = 60 kg). Neal also states that 20 vessels loaded with more than 4,000 tons of sugar sailed for Singapore and Bombay in 1841. (Neal, 1852: pp. 68-69.) Ingram mentions that by 1859 exports amounted to 204,000 *picul*, a rise from 107,000 *picul* in 1849. (Ingram, 1971: p. 123.)

74. Ministry of Commerce and Communications, 1930: pp. 220-221; Credner, 1935: p. 241.

75. *PPKR III, IV*: p. 713.

Chin river–Sakhonburi–the Mahachai canal) to the capital was too long. The route between the sugar production area and the capital had to be reduced.

The Chedi Bucha canal (k.11, fig. 4). Rama IV, who had carried out large-scale repairs of the Mon relics of the Phra Pathom Čhedi and constructed his own palace nearby, ordered the excavation of a canal between Nakhon Chaisi and the Čhedi. The chronicle states that this canal was dug from Tha Na, through the palace, to Wat Phangam, a length of 448 *sen* (17.92 km)[76]. It was continued westward from a ferry at Tha Na, Nakhon Chaisi, which is found at a marketplace called Talat Tha Na at point B on the topographical map (k. ll, fig. 4)[77]. The chronicle also states that for a royal visit of the king in the dry season, a road 150 *sen* (6 km) long was constructed between Čhao Sadao and the palace. The village name Čhao Sadao is at point C[78]. This region is not part of the delta, but is first part of the deltaic high, then of the fan-terrace complex area, so a road would be necessary in the dry season. According to *A History of the Ministry of Agriculture*, although the canal was excavated primarily for the benefit of people making their pilgrimages to the Phra Pathom Čhedi[79], sugarcane transportation was also a specific aim[80].

For navigation between Nakhon Chaisi and the capital, it is highly probable that, other than the long route through the Mahachai canal, boats also used the Yong or Bang Yai canal (k. 12) running eastward from Nakhon Chaisi, though the date of its excavation is uncertain. Using this canal, they could either go via Nonthaburi or directly to the capital through the meandering Mae Nam Om, an old channel of the Chao Phraya river. The Yong canal, however, was shallow at this

76. *Ibid.*, pp. 804-805.
77. See the Nakhon Chaisi sheet, 494/4-47.
78. See the Nakhon Pathom sheet, 493/4-47.
79. *PKK*: pp. 133-134.
80. Although Prince Damrong mentions that in the latter part of the fifth reign, there were still 17 sugar factories, and sugar factory tax for one year was 100 *chang* in Phra Pathom Chedi District. (Damrong, 1968: pp. 15-16.)

period; so boats had to be towed in the dry season[81]. Thus, as a consequence of the opening of the Chedi Bucha canal, the region specializing in sugarcane cultivation was connected with the capital and chief port.

The decline of sugarcane cultivation and the steady rise of rice prices gradually brought about canal construction with the principal object of reclamation of riceland in the lower delta region. Most of this canal construction took place in the part of the deltaic high lying between the Chao Phraya and the Tha Chin rivers, to the west of the capital, in the 1860s. This region provided easier access for rice cultivation and dwellings than the delta flat area. Within only slightly more than ten years, an integrated framework of inland navigation was built up connecting these main channels and the Maeklong river, which the transverse Damnoen Saduak canal joined. Existing main canals such as the Mahachai canal of the Ayutthaya period and the Chedi Bucha canal also complemented this system, and functioned as trunk canals in the lower delta region.

Although most of these canals, built for both water transportation and irrigation of adjacent land, provided to a certain extent for expansion of riceland, such vast tracts of uncultivated land were not always rapidly transformed into riceland by peasant reclamation. It was the outstanding characteristic of canal development in this period that, although large-scale land-holdings by the royal family and high-ranking officials developed along the newly excavated canals, large tracts of land were left uncultivated. The government was compelled to invest heavily in these canal projects because of the shortage of royal finance[82], and therefore had to adopt some effective means of raising the necessary capital. High-ranking noble officials and wealthy Chinese thus came to play an important part in these projects. Here I discuss the construction of the later trunk canals, using the Mahasawat, Damnoen Saduak and Phasi Charoen canals as examples.

81. *Akkharanukrom Phumisat Thai* ("Geographical Dictionary of Thailand") is abbreviated to *APT*: vol. 2, pp. 171.

82. Shortage of royal finance of this period was mainly caused by the abolition of royal trading monopolies, unstable tax conditions under the farm system, and a considerable increase in government expenditure. (Ingram, 1971: pp. 176-177; Wira, 1961: pp. 104-106.)

The Mahasawat canal (k. 13, figs. 4, 6, 7). According to the chronicle, the king ordered the Minister of Finance, Čhao Phraya Rawiwong Maha Kosathibodi, and Phra Sisombat to excavate a canal westward from near the Bang Kruai short-cut canal northeast of Bangkok to the Tha Chin river northeast of Nakhon Chaisi, 676 *sen* (27.04 km) in length, 7 *wa* (14m) wide and and 6 *sok* (3m) deep, beginning in L.E. 1219 (A D. 1857)[83]. However, there is slight confusion over this starting date, because *Collected Chronicles*, volume 25, reports that work started in B.E. 2403 (A.D. 1860) and was completed within that year[84]. According to the chronicles, the wages of the Chinese laborers, which amounted to 1,101 *chang*, 10 *tamlüng* (88,120 baht), were appropriated from a forfeited bequest of about 1,000 *chang* (80,000 baht), which Thao Thep Akon Čhao Talat had accumulated, and the deficiency was covered by 100 *chang* from the Ministry of Finance and 1 *chang*, 10 *tamlüng* from the Minister as chief director. If one compares this figure with the revenue of the Ministry of Finance at this period, it appears that a considerable amount of money was invested in one canal project. Pallegoix's and Malloch's figures[85] of around 20 million baht appear to be overestimates, so if one accepts that the amount of revenue was 1,947,369 baht in 1857 and 2,197,121 baht in 1860[86], wages of 88,120 baht equal 4.4 per cent of the national budget.

This canal, to the south of the existing Yong canal, was intended as the shortest route for transportation of native products, such as rice and sugarcane, between Nakhon Chaisi and the capital, as well as to bring adjacent land under cultivation. The Royal Draft of the Proclamation for the Royal Grant of Land to Princes and Princesses, B.E. 2404 (A.D. 1861), in *Collected Laws* states:

83. *PPKR III, IV*: pp. 530-531.
84. *PP 25*: p. 295.
85. Pallegoix's estimate comes to 26,964,100 baht and Malloch's to 33,372,000 baht. In particular, the figures of 12,000,000 baht (Pallegoix) and 22,380,000 baht (Malloch) for money payments in lieu of corvée seem incredibly exaggerated. (Pallegoix, 1854: tome 1, pp. 309-311; Malloch, 1852: p. 64).
86. Wira, 1961: p. 74.

> A plain extending over both Nonthaburi and Nakhon Chaisi Provinces along the newly excavated canal which runs between Bang Khwang and Ban Ngiorai had been left uncultivated, so there had been no one to hold it. When the canal was excavated, the King ordered Čhao Phraya Rawiwong Maha Kosathibodi, Minister of Finance and chief director of canal excavation, to make it into royal riceland. There are 1,620 *rai* [259.2 hectares (ha)] on the north bank in Nonthaburi Province, and 9,396 *rai* [1,503.36 ha] on the north bank and 5,184 *rai* [829.44 ha] on the south bank in Nakhon Chaisi Province; 16,200 *rai* in all. This land is divided into 50 plots; one plot is 324 *rai* [51.84 ha], being 60 *sen* [2.4 km] long and 5 *sen*, 8 *wa* [216 m] wide. As there is no landowner, the King is in full possession of this land and will grant some plots to princes and princesses, so that some will get one plot and some will get two. They should be cultivated by corvée peasants or leased to other people . . . This newly reclaimed riceland is exempt from land tax under the terms of the previous proclamation. But this kind of riceland cannot be sold to others. . . Hereafter, the holder of this riceland is exempt from land tax until the *tradaeng* deed now issued requires renewal.[87]

Areas with convenient access, bordering Nonthaburi and Bangkok and the Tha Chin river, might have been already occupied at the time of canal excavation or even before. Rama IV intended to divide the unoccupied wasteland along the central part of the canal into rectangular plots, 2.4 km by 216 m, among his princes and princesses. In addition, he encouraged cultivation by issuing a *tradaeng* deed which gave exemption from land tax for two years. In other words, a landlord-tenant system, with large-scale land-holding by royalty, was planned.

How was this large-scale estate farming, derived from canal construction, to be operated? Prince Damrong's report concerning the riceland along this canal submitted to the throne in R.E. 122 (A.D. 1903), which includes a land register map and a list of royal landowners, provides much useful information on this subject[88]. Figure 6 shows the register map itself, while figure 7 shows the Mahasawat canal region as of 1913 or 1914. In figure 6, the canal crossing the rectangular plots

87. "Prakat rang phraratchahatlekha phraratchathan na phrachaolukthoe" (*PKPS*: vol. 6, pp. 273-274.)

88. Damrong, 1903: "Rüang thina nai khlong mahasawat" (manuscript).

diagonally is the Naraphirom and Thawi Watthana canal, which was excavated between 1878 and 1880[89]. From the shape of the plots on the register map, there are considerable deviations from the originally prescribed 60 *sen* by 5 *sen* 8 *wa* (324 *rai*). Prince Damrong writes:

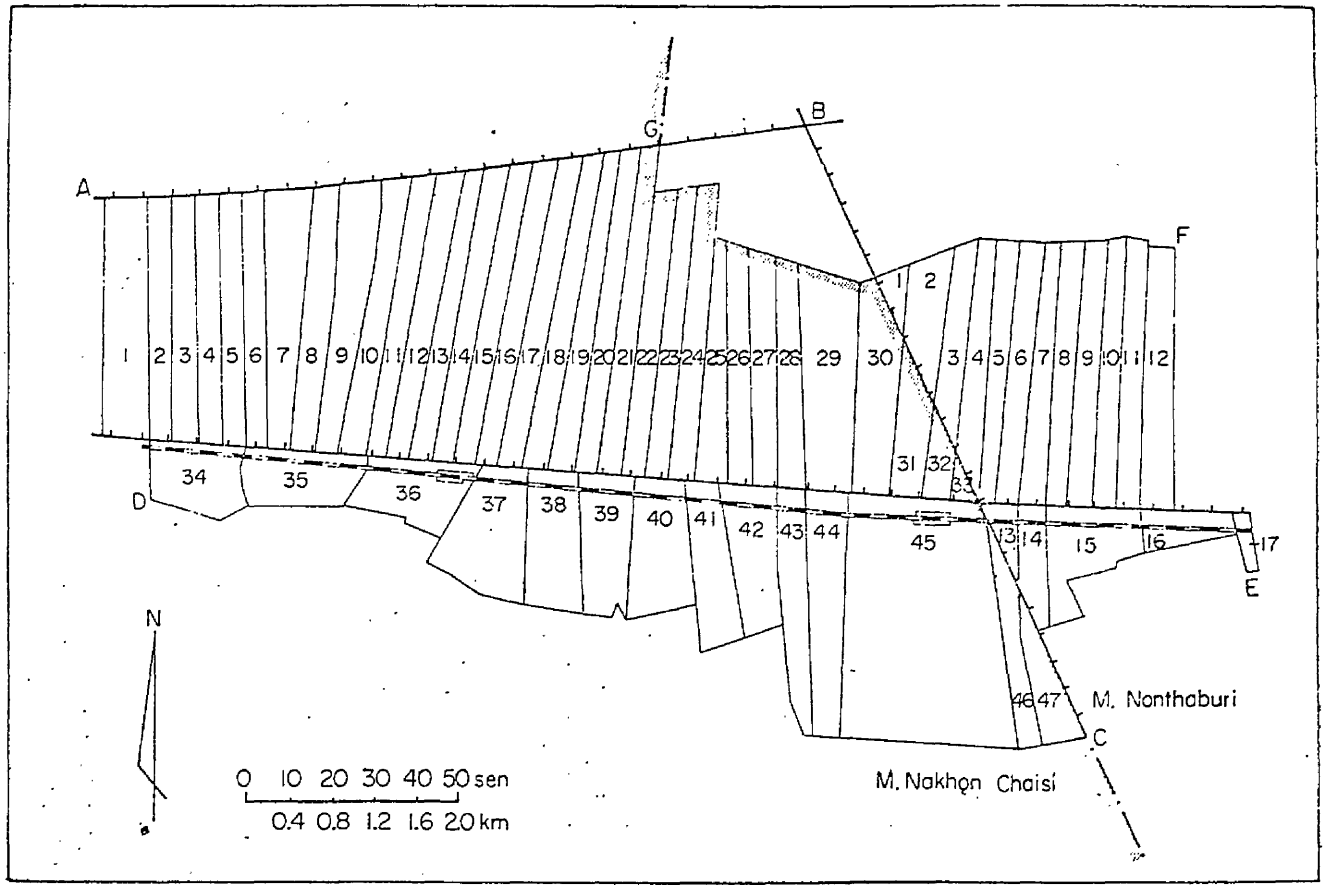
> The reason for this seems to be that these plots were not previously accurately surveyed. When the time came to stake out their borders with peasants' riceland, much of the riceland granted by the king on the south bank had to be staked out wider than the provisions. Even though most of the plots on the north bank could be staked out almost as in the provisions, their northernmost sides are not equal. The plots in the east are wider than those in the west, because the Yong canal [A–B, k. 12] which borders the plots, slopes in a southwesterly direction. So most of these plots are not 60 *sen* [2.4 km] long. And so the area of these plots along the Mahasawat, which the owners received as a royal grant, do not conform to the specifications of the proclamation, and were not equal from the beginning.[90]

The irregular border of the southern plots, bounded by "peasants' ricelands", suggests that reclamation by peasants began to develop at the close of the nineteenth century[91]. Small, irregular channels running toward the Mahasawat canal from the Tha Chin river might have been used for irrigation of these reclaimed ricelands. This southern border and the northern F–G line composed of dikes separating ricelands indicated landownership, as well as, from the end of the nineteenth century, the administrative boundaries of districts *(amphoe)* or provinces *(čhangwat)*.

Although some plots are more than 500 *rai* in area, most plots thus granted are around 300 *rai* (48 ha). Even the plots granted to Rama V, including those added later that formerly belonged to other members of royalty, only total 1,896.66 *rai* (303.47 ha). Dilock states that around A.D. 1900 one household cultivated about 80 to 100 *rai* on average, and in well-irrigated areas would be able to cultivate up to about 200 *rai* in central Thailand[92]. Such plots granted by the king

89. *PKK*: pp. 142-145.
90. Damrong, 1903: (manuscript).
91. For the conditions of rural society in that period, see the results of field research conducted by Suthon. (Suthon, 1975: pp. 60-76.)
92. Dilock, 1908: p. 98.

Figure 6. Land register map of the Mabasawat area, R.S. 122 (A.D. 1903)

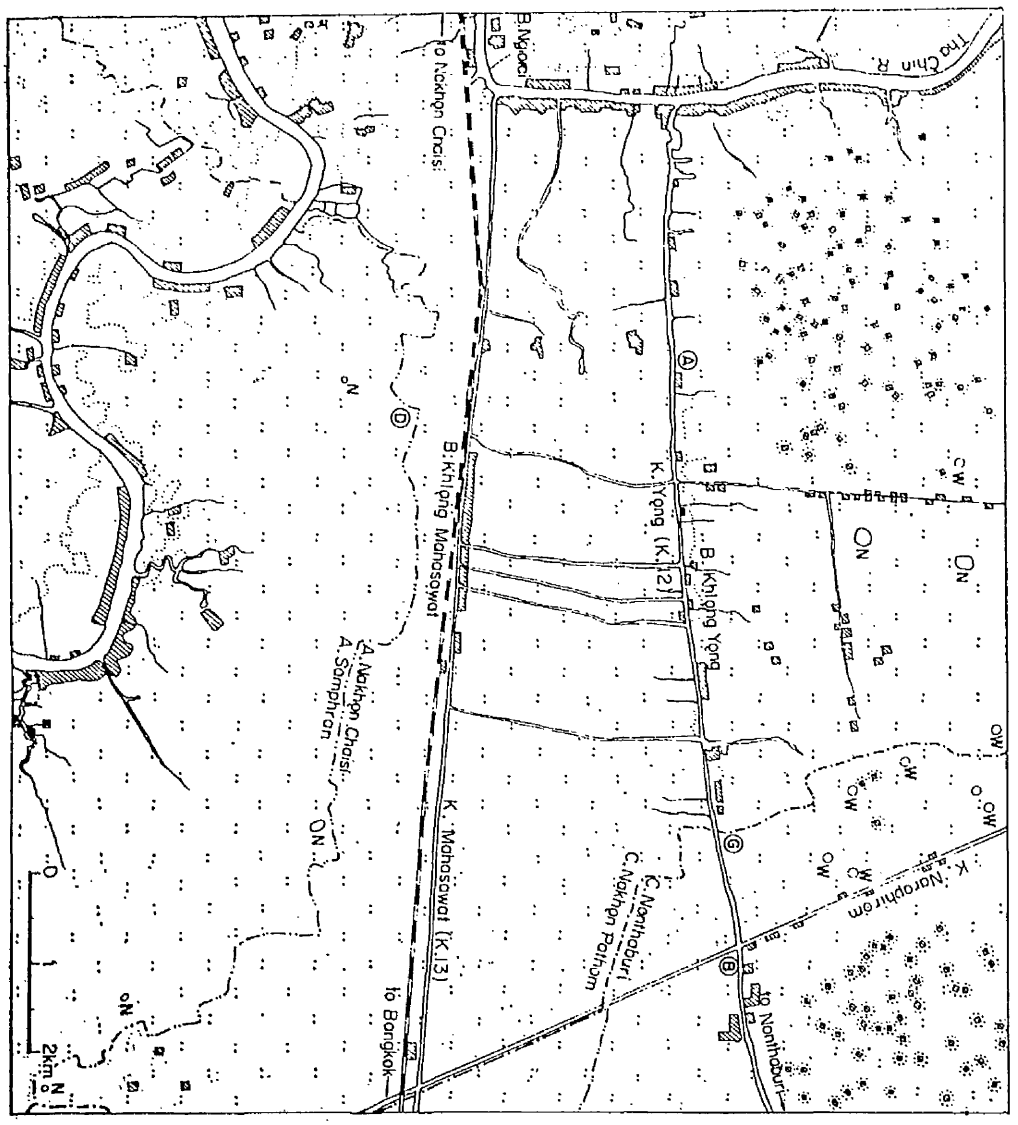


From Damrong, 1903

Notes: 1. N.C. 30 (Nakhon Chaisi 30) and N. 1 (Nonthaburi 1), N.C. 31 and N. 2, N.C. 32 and N. 3, N.C. 33 and N. 4, N.C. 46 and N. 13, N.C. 47 and N. 14, were each granted to one individual.

2. Only N.C. 25 and N.C. 29 were held by people other than the sons and daughters of Rama IV. N.C. 25 was granted to a high official by Rama IV, and N.C. 29 was held by an official himself who was engaged in division of the land by order of the Minister of Finance. The largest plot of land, N.C. 45, belonged to the prince who later became Rama V, and, together with the land granted to the other sons of Rama IV, its area was 1,896.66 *rai* (303.47 hectares).

Figure 7. The Mahasawat canal region



: River channel or canal Ⓐ Ⓑ Ⓓ Ⓖ : The points correspond with those in Fig. 6.
: Railway B : Village
: Village N : Swamp or Reservoir
: Rice fields W : Pond or Well

Notes: Based on the 1:50,000 topographical maps surveyed by the Division of Maps, Royal Thai Army, in 1913: the Ban Bangrakam sheet (published 1956), and the Nakhon Chaisi sheet (published 1914).
Neither sheet was revised in the 1950s. North of the Yong canal there seem to be isolated dwellings, scattered among the paddy fields, but the details are not clear. This suggests that the morphogenesis of these settlements can be explained by their location, as these scattered dwellings are on the delta flat, while most other dwellings are on the deltaic high.

were not too large to cultivate by the broadcast method, under which the fields are flooded during the rainy season and labor productivity is high. These plots were, however, not always fully cultivated by corvée peasants or tenants under the traditional client-patron relationship. The following description clearly suggests that.

> In that time there were only a few cultivators, and there were vast amounts of wasteland. Although there were a few people who went to cultivate them, there was not enough labor for the granted area. At first, then, these lands were in good order, and there was no mutual infringement of land. When prospects for these lands became better after R.E. 115 [A.D. 1896] with the good price for rice, the area filled with peasants to cultivate it. Then mutual infringements frequently occurred at the edges of plots. Thus it came to be necessary to send me to stake out these plots at this time.[93]

From this description it is obvious that, in spite of the establishment of large-scale land-holdings by royalty, concomitant with a large canal project in Rama IV's reign and the first half of Rama V's reign, still a large estate or a landlord-tenant system could not be operated unless corvée peasant or 'debt-slave' labor was employed under the traditional relationship[94]. A large estate of over 1,000 *rai* (160 ha) operated by an eminent noble official and employing debt slaves was also reported by a foreigner in 1884 as lying along this canal[95]. Debt slaves were probably often used by royalty or noble officials at the turn of the century, because the newly acquired large-scale lands suffered a perpetual shortage of labor, although slavery was soon abolished and gradually transformed into a landlord-tenant system[96]. It took many years for free peasants to appear, through the disintegration of the traditional client-patron relationship and the increase in foreign demand for rice, and to transform these semi-wastelands into cultivated riceland. The period since A.D. 1896 roughly corresponds to the period of disintegration of corvée conscription[97]. From that time, with increasing disputes over riceland, the government was faced with the necessity of land registration in the newly occupied lands of the lower delta region.

93. Damrong, 1903: (manuscript).
94. Dilock, 1908: pp. 96-97.
95. Hardouin, 1884: p. 192.
96. For economic conditions in this transitional period, see Ammar's discussion. (Ammar, 1972: p. 23.)
97. Ishii, 1966: pp. 43-45.

The Damnoen Saduak canal (k. 14, fig. 4). The chronicle reads:

> On Monday, the fourth day of the waxing moon of the seventh month [25 May 1868 A.D.], the Minister of Military Affairs went to the opening of the newly excavated canal at Bang Nokkhwaek. Excavation of this canal was started at the end of the Year of the Tiger, eight of the decade [A.D. 1866/7], westward from the east bank of the Bang Yang river in Nakhon Chaisi Province to the Bang Nokkhwaek canal in Ratchaburi Province. It is 840 *sen* [33.6 km] long, 6 *wa* [12 m] wide and 6 *sok* [3 m] deep. Wages for excavation and removing tree stumps amounted to 1,400 *chang* [112,000 baht], of which 1,000 *chang* [80,000 baht] was appropriated from the Minister of Military Affairs and 400 *chang* [32,000 baht] granted by the King.[98]

The project was carried out under direction of Somdet Čhao Phraya Sisuriyawong (Chuang Bunnag), who had held the high official position of Minister of Military Affairs. A source mentions that he acquired large areas of unclaimed land along the canal as collateral for his heavy investment[99]. In fact, this heavy investment by Sisuriyawong, as Rama V wrote in a later letter, was appropriated from the balance of the sugar tax revenue which had been put in Sisuriyawong's charge for construction of a palace at Phetchaburi[100]. Sisuriyawong took full advantage of the project, distributing lands along the canal to his wives, relatives and dependants, and selling it to others for cultivation. Large-scale landholding was thus established here as along the Mahasawat canal.

The Damnoen Saduak canal, linking fortified towns at the river mouths in place of the existing Sunak Hon channel, was intended to develop water transportation between the Tha Chin and Maeklong rivers. Rice produced in the Ratchaburi area, and fruit and vegetables from the Chinese plantations on the natural levees of the Maeklong river, could reach Tha Chin river by this new straight canal rather than by the existing coastal channels, which were winding and troublesome to navigate[101]. For transport to the capital, this canal must be considered in conjunction with the Phasi Charoen canal.

98. *PPKR III, IV*: p. 711.
99. *PP 25*: pp. 297-298.
100. Čhunlachomklao, 1927: p. 3.
101. Smyth, 1898: vol. 1, pp. 277-278; Bacon, 1892: pp. 217-218.

The Phasi Charoen canal (k. 15, fig. 4). The famous Phasi Charoen canal had a somewhat curious beginning in a Chinese appeal for its construction in L.E. 1227 (A D. 1865). A Chinese opium and sugarcane tax farmer, Phra Phasi Sombatboribun (Pho Jim), later referred to by Rama V, who had extended his commercial operations in sugarcane at Don Kradi on the east bank of the Tha Chin river, proposed the construction of a canal to facilitate transportation between his commercial base and the capital[102]. According to his proposal, widely known as Prakat Khut Khlong Phasi Charoen[103], the government could not provide sufficient finance for the project because of shortage of revenue, chiefly caused by abolition of the orchard tax *(akon suan yai)* and the shortfall in rice export tax *(phasi khao)* in that year[104]. So, citing the foreign example of public subscription for works, he suggested two methods of financing : the first was the collection of a toll, according to the size of boat, for the next ten years, and the second was the establishment of gambling houses *(rong huai)* at Nakhon Chaisi and Tha Chin (Samut Sakhon), for three years[105]. Although it is not clear whether his proposals were approved, ultimately his revenue from a contract for opium-tax farming, 1,400 *chang* (112,000 baht), seems to have been expended on the project. This suggests that Chinese financial power, mostly obtained from various kinds of tax farming, began to establish control over canal projects, which had been traditionally regarded as the type of public works undertaken by government.

Certainly this canal, although frequently mentioned as planned with the sole object of transportation, seems to have also been intended to open unclaimed lands to some extent. In his proposal, Phra Phasi Sombatboribun referred, briefly but clearly, to the levying of land tax on people who reclaim and hold lands which extend up to 15 *sen* (600 m) from each bank[106]. Judging from his expectation of a land tax in the

102. Čhunlachomklao, 1927: p. 2.

103. *PKPS*: vol. 7, p. 154.

104. For the orchard tax and the rice export tax, which seem to have been collected by Chinese tax farmers, see Damrong, 1923: pp. 22-33; Dilock, 1908: pp. 85-88.

105. *PKPS*: vol. 7, pp. 155-156.

west bank region along this canal, intensive farming had been developed by Chinese in the western outskirts of Bangkok, especially in the old Bangkok Yai canal area[107]. That canal, connecting with the Damnoen Saduak canal, was most important for water transportation in the west bank region. In the 1880s, a royal decree for the repair of the latter canal refers to the improvement of transport facilities between provincial towns along the Nakhon Chaisi river and the Chao Phraya main channel since the construction of the Phasi Charoen canal, planned and built in the reign of Rama IV[108].

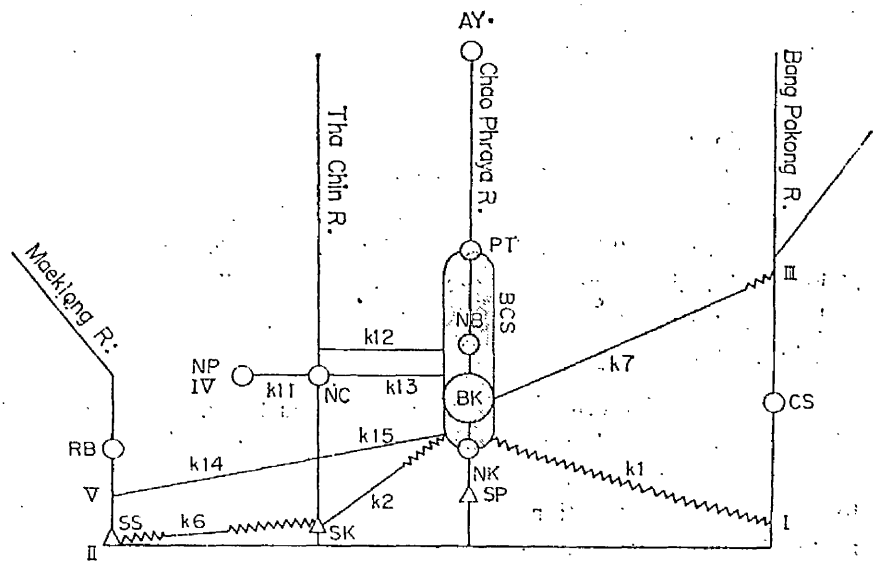
Besides the excavation of such trunk canals, some canal projects chiefly financed by eminent noble officials such as Somdet Čhao Phraya Sisuriyawong and the Minister of Harbors, Čhao Phraya Thipphakorawong, are mentioned in the *Dynastic Chronicle*. Those include excavation and repair projects carried out in Samut Songkhram Province (the Bang Li canal and the Yi San short-cut canal), and Samut Sakhon Province (the Khun short-cut canal and the Krut short-cut canal), coastal areas of the west bank[109].

V. Conclusion

The canal system constructed prior to the fifth reign on the east and west banks of the lower part of the Chao Phraya delta is shown in figure 8. The entire water-transportation network of this part of the delta region evolved through the historical development of two canal networks. (a) The network of numerous channels, including old river channels and short-cut canals mainly constructed in the Ayutthaya period, made up a system of water transportation for the markets and harbors of the capital, which can be termed the Greater Bangkok canal system, stretching from Pathum Thani in the north to Nakhon Khüankhan or Phra Pradaeng in the south, with Bangkok as the center. Water transportation in the kingdom's core or *Wong Ratchathani*, which extended from

106. *Ibid.*: p. 156.
107. Skinner, 1957: p. 113; Sternstein, 1966a: p. 58. In particular, see Bradley's map for A.D. 1870, cited in Sternstein's article.
108. Prakat Khut Khlong Phasi Charoen, C.S. 1247-1248, *PKPS*: vol. 11, p. 7.
109. *PPKR III, IV*: 712-713.

Figure 8. The canal system of the lower part of the Chao Phraya delta, in the mid-nineteenth century



BCS: Greater Bangkok canal system
AY : Ayutthaya
PT : Pathum Thani
NB : Nonthaburi
BK : Bangkok
NK : Nakhon Khüankhan (Phra Pradaeng)
SP : Samut Prakan
CS : Chachoengsao
NC : Nakhon Chaisi
NP : Nakhon Pathom
SK : Sakhonburi (Samut Sakhon)
RB : Ratchaburi
SS : Samut Songkhram

k1 : K. Samrong
k2 : K. Mahachai
k6 : K. Sunak Hon
k7 : K. Saen Saep
k11 : K. Chedi Bucha
k12 : K. Yong
k13 : K. Mahasawat
k14 : K. Damnoen Saduak
k15 : K. Phasi Charoen
○ : *krung* ("capital")
o : *huamüang* ("provincial town")
△ : *huamüang pak nam* ("fortified rivermouth town")

the capital city area, always consisted of this canal system, even when Ayutthaya was the capital[110]. (b) Long-distance canals, linked to provincial towns on other rivers and constructed for military affairs, movement of goods, and expansion of cultivated land through irrigation, form a supplementary trunk canal system connecting with the Greater Bangkok canal system.

Within the trunk canal system, routes I and II, running east-west with meandering parts on the coastal delta flat, were transverse channels constructed in early times. At the junctions of channels and at such *hua müang pak nam* ("fortified rivermouth towns)" as Samut Prakan and Nakhon Khüankhan, military bases were situated. Those two routes, and the Saen Saep canal, route III, of a later period, played an important part in military affairs.

In the mid-nineteenth century, during the fourth reign, construction of trunk canals was begun with the improvement of route IV for the transportation of truck-farm produce, especially sugarcane. This was followed by the excavation of the Mahasawat canal, which completed route IV, and of the Damnoen Saduak and Phasi Charoen canals, route V, which were intended for the transportation of rice, fruit and vegetables as well as the expansion of riceland in the deltaic high region. Although a water transportation system composed of old and new canal systems on the west bank was developed, vast areas of land stretching toward the Bang Pakong river on the east were left uncultivated. New trunk canal construction projects to the east might have been expected, to facilitate transportation from the Chachoengsao region where rice cultivation had been fully developed by this period, and to reclaim wasteland, but that did not occur until the fifth reign.

Establishment of the trunk canal system on the west bank was, in part, intended to encourage reclamation of wasteland, and it led to the appearance of large-scale land-holding under the traditional client-patron

110. *Wong Ratchathani* in the latter part of the nineteenth century seems to have been reduced to a few provinces near the capital, such as Pathum Thani, Nonthaburi, Phra Pradaeng and Samut Prakan, which fully correspond with the Greater Bangkok canal system. (Tej, 1968: p. 34.)

relationship. Vast amounts of this land were left uncultivated, although such lands held by royalty and eminent noble officials seem to have been cultivated by corvée peasants and debt slaves still bound by the client-patron relationship. The landlord-tenant system of the Mahasawat canal area was also founded on the traditional social relationships of Thai society[111]. Thus it appears that the expansion of riceland through the construction of canals in the mid-nineteenth century took place only within the very rigid limits of traditional society.

111. The landlord-tenant system developed in the traditional society does not have the same character as the modern landlord-tenant system that is based on payment of rent. (Dilock, 1908: pp. 96-99; Tomosugi, 1967: pp. 102-103.)

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Land Reclamation in the Chao Phraya Delta

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In the previous chapter Ishii described the relationship between the ecological conditions for rice growing in the Chao Phraya water system and the process of historical development in Thailand. In part II, chapter 7, this will be further clarified by Takaya's detailed topographical analysis. Here I will attempt to clarify the relationship between the expansion of rice cultivation in the old delta or floodplain of the Chao Phraya water system and in the extensive young delta further downstream, and the states and peasant societies which evolved there.

Through his ecological analysis of rice cultivation, the production basis of the Thai states which flourished on this water system, Ishii defined the Lanna Thai kingdom of the intermontane basins of the North and the Sukhothai kingdom established on a fan-terrace complex as "quasi-hydraulic societies" entailing a certain level of state participation in irrigation. In contrast, the Ayutthaya kingdom, with which the core area shifted to the old delta in the sixteenth century, was seen to exhibit features of a commercial state based on foreign trade, namely, the "maritime" location of the capital, the fact that rice cultivation depended on natural conditions, that is, involved "agronomic" rather than "technological" adaptation to nature, and the fact that the state turned to the trade of rare products of the outlying provinces which it received as tribute. These features of the Ayutthaya dynasty were retained through the Thonburi and early Ratanakosin periods until the start of the twentieth century.

In this chapter I attempt to show the process of transition from the "medieval" commercial state to the "modern" state based on the production of rice for export, within the context of the reclamation of

ricelands that took place between the early Ratanakosin era and the beginning of this century, bearing in mind the ecological hypothesis.

RECLAMATION OF RICELANDS AND CANAL SYSTEMS

General Background of Riceland Reclamation

Watabe's investigation of the rice husks contained in the bricks of historical remains has shown that wet rice was cultivated at least as early as the sixth century in the margins of the delta (chapter 1, Fig. 3). These diagrams of the distribution of husk types in the delta by period show clearly the process in which wet rice was first grown in the delta north of Ayutthaya from the eleventh to the fifteenth centuries, expanded in the same area from the fifteenth to eighteenth centuries, and spread rapidly to the young delta in and after the eighteenth century.

These ecological changes and the process of expansion of wet rice cultivation relate closely to the historical evolution of the society whose main occupation was and is the cultivation of paddy. The changes in distribution of wet rice in the Chao Phraya delta, while supporting Watabe's argument regarding the dissemination of wet rice, also suggest that by the end of the Ayutthaya period (late-eighteenth century) the reclamation of ricelands in the upper reaches of the old delta was losing impetus and that interest was shifting to the young delta, a vast undeveloped tract of swampy lowland. This then was the start of the transition from the "medieval" wet-rice culture that relied heavily on the natural conditions in the floodplain of the old delta. The following hundred or so years saw the large-scale expansion of rice cultivation into the young delta and the emergence of "modern" export-oriented agriculture. And it was in this transition period that, in the second half of the nineteenth century, the Bowring Treaty stimulated the rapid expansion of rice cultivation into the young delta through the liberalization of trade and the abolition of the royal trade monopolies.

One salient feature of agricultural management in the young delta is the specialization in rice. This commercial monoculture developed in response to demand for rice from China and other Asian countries in the last half of the nineteenth century. Before this, sugarcane and other dry-season upland crops had also been cultivated on a commercial scale, but in the period of socioeconomic change in the last half of the nineteenth century it was wet rice, the traditional crop of the Thais, that developed from a subsistence crop to the export-oriented commercial product of the vast young delta.

This monoculture of rice for export in the young delta in some

aspects resembles the plantation agriculture, for example, of the rubber estates of Malaya. The rice export economy of the late nineteenth century was strongly influenced by the concept of international division of labor, a pillar of colonial economic organization, and the government deliberately promoted the development of the monoculture of rice based on such thinking. Here the analogy ends, however, since the plantations were generally established through the union of colonial capital and technology with cheap native labor, whereas the monoculture of rice in the delta was established basically through Thai entrepreneurship with traditional Thai cultivation techniques. And while most plantations were managed as estates employing huge agricultural workforces, the rice culture of the delta, despite a marked increase in tenancy with the formation of large landholdings, developed largely through the small farm management of numerous independent farmers. Nevertheless, in that it was a monoculture that developed rapidly within the framework of a colonial-type economy, rice cultivation in the young delta assumed the characteristics that led Ishii to term it "plantation-type" agriculture.

How then was this expansion of rice cultivation into the young delta brought about? Certainly there were no revolutionary changes in cultivation techniques from those employed in the "medieval" agriculture that depended on the annual flooding of the rivers. The land was still prepared by plowing and harrowing by buffalo and harvesting was carried out by hand, requiring the mobilization of most of the work force. The greatest change was probably the increased use of broadcast seeding in preference to transplanting in the larger cultivated areas. The floating rice cultivation in the Ayutthaya period that Ishii quoted from *Ka-i Hentai* is probably not typical of "medieval" agriculture; rather it represents an outsider's impression of rice cultivation in the deep-water belt near Ayutthaya.[1]

Broadcasting was prevalent in the expansion of cultivation into the deepwater belt (*thi lum*), where floating rice must be chosen, and onto the elevations (*thi don*), where only rain-fed culture is possible. This expansion occurred mostly from the end of the nineteenth century.

1. At the start of the twentieth century, as today, *khao na muang* (floating rice or "field rice") was cultivated only in the deep-water belt near Ayutthaya, a part of the young delta. It was almost certainly cultivated in the same area before this, though not as widely as today. See J. H. Van der Heide, *General Report on Irrigation and Drainage in the Lower Menam Valley* (Bangkok: Ministry of Agriculture, 1903), pp. 46–48; and Suvabhan Sanitwongse na Ayutthaya, *Ruang khao khong prathet sayam* [The rice of Siam] Cremation volume of Nai Phantri Momratchawong Suwaphan Sanitwong na Ayutthaya (Bangkok, 1927), pp. 3–6.

For example, the deepwater belt near Ayutthaya from Phakhai to Sena was a wasteland frequented by thieves and wild animals until it was converted to riceland at the turn of the century by a rush of settlers. At any rate, in the expansion of ricelands into the young delta, transplanting culture of the earlier period was carried on in parallel with the more extensive broadcast seeding.[2]

It was through the labors of the peasants then, rather than the introduction of any revolutionary techniques, that new ricelands were reclaimed in the wastelands of the young delta. The gradual liberation of the corvée peasants (*phrai*) and debt slaves (*that*) that accompanied the dismantling of the old social order in the late nineteenth century allowed these people freedom of migration between regions and supplied the work force for the reclamation of the young delta.[3] Thus around the turn of the century a huge number of peasants migrated to the young delta in search of new land, many of them from the Northeast or Isan, where rice cultivation was unstable and mostly dependent on rainwater, and from other parts of the Central Plain.

After the construction of the Rangsit canal system in 1890, several tens of thousands of peasants settled in the area from various regions.[4] This period also saw an influx of seasonal agricultural laborers from the Northeast. At harvest season many Northeastern peasants gathered at Nakhon Ratchasima, an important gateway to the Central Plain, and waited for calls for day laborers (*khon rap chang*) from farms in the delta.[5]

Thus the disorganization of the old system at the end of the nineteenth century brought mobility to the peasant population and provided the mammoth work force needed to clear and cultivate the young delta. There was, however, little change in the management of rice-growing. Most of the cultivation work was performed by the farmhouse work force, and for transplanting and harvesting when a larger work force was required the traditional system of mutual exchange of labor (*ao raeng, kho raeng*) probably continued to function. In addition, the employment of day laborers, particularly from the Northeast, became more widespread. On the other hand, as I will describe later,

2. On broadcasting, see Lucien M. Hanks, *Rice and Man, Agricultural Ecology in Southeast Asia* (Chicago: Aldine-Atherton, 1972), pp. 33–36.
3. On the disorganization of the corvée system and the emancipation of debt slaves, see Yoneo Ishii, *Tai ni okeru fujiyurodosei no kaitai* [Disorganization of the corvée and slave systems in Thailand] (Tokyo: Institute of Developing Economies, 1966).
4. Chaophraya Wongsanupraphat, *Ruang prawat krasuang kasettrathikan* [A history of the Ministry of Agriculture] Cremation volume of Nai Phonek Chaophraya Wongsanupraphat (Bangkok: 1941), p. 154.
5. David Bruce Johnston, "Rural Society and the Rice Economy in Thailand, 1880–1930," (Ph.D. diss., Yale University, 1975), part 5, pp. 19–20.

the accumulation of large landholdings by members of the royal family and noble officials led to establishment of the landlord-tenant system over a wide area, although some large estates were cultivated by full-time agricultural laborers (*luk chang*).[6]

The peasant settlers attempting to clear and cultivate the young delta were confronted with an unimaginable wilderness. In the dry season like a desert, in the rainy season a sea of mud, the young delta was a place of epidemics and wild animals, and the haunt of outlawed bandits (*chon phurai*) born of the poverty of peasant society. To clear the wasteland and cultivate rice, two basic conditions had to be satisfied. The first was to provide access to the region for the peasants who would reclaim the land and build settlements, and a means of transport to distribute the produce. The second was to supply water for rice cultivation.

These two basic conditions were realized in the young delta just as they had been in the Chao Phraya basin from old times, by cutting canals. The canals at once provided access to the wastelands and water for cultivating the adjoining lands.[7] Therefore by following the development of canal construction we will be able to gain a general picture of the historical development of riceland reclamation in the young delta.

The Functions of the Canal Systems

The Thai word *khlong*, while denoting a canal or *khlong kut* constructed for inland navigation, essentially means a large or small natural tributary or distributary of a river or *maenam*. According to Anuman Rajadhon, *khlong* is derived from a Mon word meaning path or way, as in *khlong luai* (the kerf of a saw) or *khlong tham* (the way of *Dharma*), and has come to mean a watercourse, either natural or man-made, linked to a river.[8] For the people of the delta, the *khlongs* were the

6. Most of the royalty and officials were absentee landlords resident in Bangkok. Peter Anthony Thompson, *Lotus Land, being an Account of the Country and the People of Southern Siam* (London: T. Werner Laurie, 1906), p. 182; Robert L. Pendleton, *Thailand, Aspects of Landscape and Life* (New York: Duell, Sloan and Pearce, 1962), pp. 169–171.
7. The irrigation systems were based on traditional technology, comprising canals through which floodwater could be led onto the rice fields only during the rainy season when the rivers were high. These primitive canals differ from "irrigation canals," through which irrigation water can be supplied to fields even in the dry season by regulation of water levels, and are called "inundation canals." Van der Heide, *Irrigation and Drainage*, pp. 25–28, 32–33.
8. Phraya Anuman Rajadhon, "Chiwit chao thai samai kon," [The old life of the Thai people] in *Chiwit chao thai samai kon lae kan suksa ruang prapheni thai* [The old life of the Thai people and a study of Thai tradition] (Bangkok: Samnakphim Khlangwitthaya, 1972), p. 305.

communication routes with the neighborhood and the trading routes for the cargo boats or *rua krachaeng* laden with paddy. At the same time they provided water for domestic use in cooking, laundry, and bathing, and drinking water in the dry season. The *khlongs* were also important for irrigating the ricelands. Whether artificial or natural, and whether or not they functioned satisfactorily for irrigation, the *khlongs* had always been regarded as the means of distributing the floodwaters of the rivers over the paddy fields to raise the rice crop. The traditional canals of the delta, the *khlongs*, can thus be regarded as serving two functions: transportation and irrigation.

During the Ayutthaya and early Bangkok periods, until the massive reclamation of ricelands began in the young delta in the late nineteenth century, canals were constructed and functioned primarily for the rationalization of water transport and the opening of communication lanes. The numerous state hydraulic works in particular showed this tendency strongly, and records of such projects appear frequently in the several versions of the Ayutthaya and early Ratanakosin royal chronicles. Between the reigns of Ramathibodi I, builder of Ayutthaya, and King Rama III of the Ratanakosin dynasty, more than twenty large-scale canals were dug, including the city moats of Bangkok. Most of these excavations were ordered by the king and were state public works carried out by an army of corvée peasants under the supervision of a high-ranking noble official appointed as chief director, or Mae Kong.[9]

Figure 1 shows the most important of the large-scale canal excavation projects completed in the Ayutthaya period. It is noteworthy that almost all the canal excavations were carried out in the young delta far downstream of the capital. Why, we may ask, did the kings of Ayutthaya order these large-scale works in this coastal region described as virtually uninhabited by the French envoy de la Loubère, who visited Ayutthaya at the end of the seventeenth century?[10]

As the figure shows, most of these canals are river channel replacements, called *khlong lat* or short-cut canals, which bypass the meanders of the Chao Phraya river, particularly in the geomorphologically young terrain between Pathum Thani and the river mouth at Phra Pradaeng.

9. Shigeharu Tanabe, *Historical Geography of the Canal System in the Chao Phraya Delta from the Ayutthaya Period to the Fourth Reign of the Ratanakosin Dynasty*, Discussion Paper no. 95 (Kyoto: The Center for Southeast Asian Studies, Kyoto University, 1977), pp. 9–10.
10. Simon de la Loubère, *The Kingdom of Siam* (Kuala Lumpur: Oxford University Press, 1969), p. xxx.

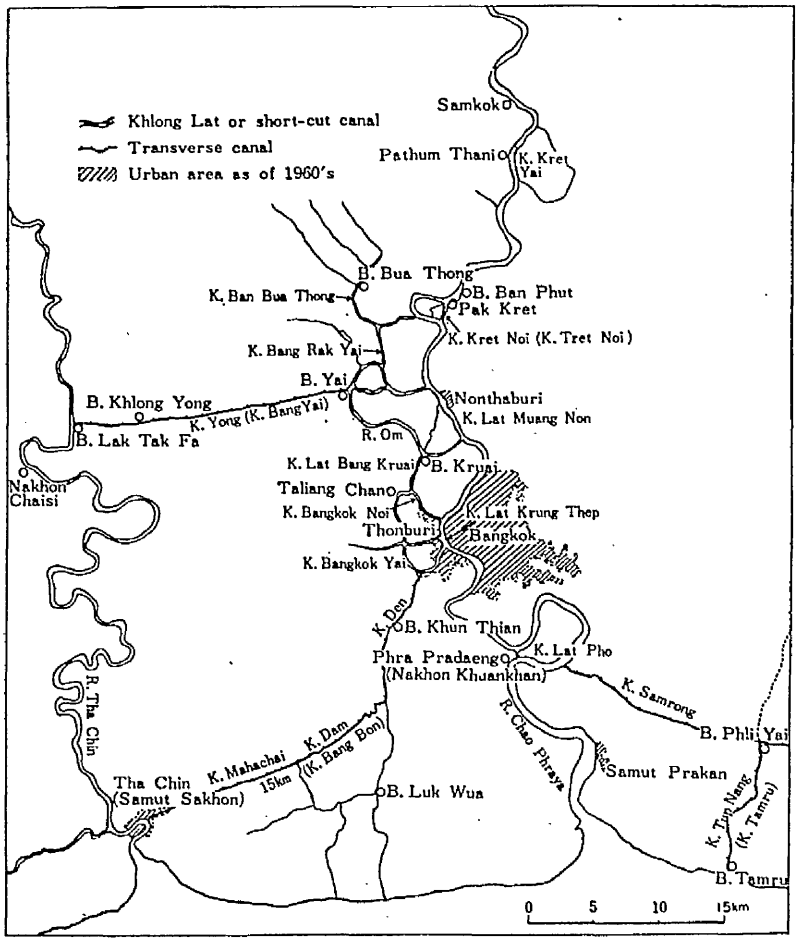


FIG. 1 SHORT-CUT CANALS AND TRANSVERSE CANALS OF THE AYUTTHAYA PERIOD

These works greatly shortened the navigation route between the capital and the Gulf of Siam.

The figure also shows canals of another type, the transverse canals, which connect the mainstream of the Chao Phraya with the major rivers flowing parallel to it. Well-known examples are the Samrong canal, which connects the Chao Phraya with the mouth of the Bang Pakong to the east, and the Mahachai canal, which connects the Chao

Phraya with the mouth of the Tha Chin to the west. According to the Phra Paramanuchit version of the Royal Chronicle of the Ayutthaya Period, in c.s. 1066 (1704/05) King Phra Phuttha Chao Sua ordered Phra Ratcha Songkhram to shorten the navigation route between the Chao Phraya and Tha Chin rivers by straightening the Khok Kham canal. Phra Ratcha Songkhram conscripted over thirty thousand *phrai* from eight *muang* in the lower delta, engaged a foreign land surveyor, and started the excavation. With the death of King Phra Phuttha Chao Sua, work on this Khok Kham or Mahachai canal was suspended, but more than ten years later in c.s. 1083 (1721/22), in the reign of King Thai Sa, work was resumed and the mouth of the Tha Chin was reached. Noteworthy in the entry in the chronicle is King Phra Phuttha Chao Sua's praise for the canal excavation works carried out by earlier kings and his appreciation that the opening of the inland navigation route through the excavation of the Khok Kham canal would be his most distinguished achievement.[11] For the kings of Ayutthaya, the securing of navigation routes by excavating canals through the sparsely populated wastelands of the young delta was the most important part of state public works.

The principal motive for improving inland navigation was military. In the continual battles with neighboring states the swift dispatch of troops and supplies required ready communication routes. And to reach strategic points at the eastern and western margins of the delta, the Malay peninsula, and Cambodia, the canals all had to pass through the young delta. It was through the linking of these canals with the natural waterways of the desolate young delta that the military actions against the Malay states and Cambodia were possible.

In addition to their military function, the waterways of the young delta also served as trade routes in peacetime. Under the old system of government the peasants were obliged not only to render corvée service but to deliver part of their produce to the king. In lieu of corvée service, peasants in the outlying districts were required to convey such tributary goods (*suai*) as construction materials and the rare products of the provinces to the capital. The southern *muangs* of the Malay peninsula in particular produced numerous luxury goods which were collected in the capital and supported the royal export trade monopolies. In transporting *suai* from the south and from the marginal regions of the

11. "Phraratchaphongsawadan krung si ayutthaya chabap Phra Paramanuchit" [The Phra Paramanuchit version of the Royal Chronicles of the Ayutthaya dynasty] *Phraratchaphongsawadan krung si ayutthaya lae phongsawadan nua* [The Royal Chronicles of the Ayutthaya dynasty and the Chronicle of the Northern Provinces] (Bangkok: Ongkankha khong Khrusapha, 1961), 1: 204–205.

delta, the canals played an important part. In addition, large junks, or *rua samphao*, engaged in foreign trade could enter the capital port along the Chao Phraya by taking advantage of the short-cut canals.

At the end of the eighteenth century when the new capitals of Thonburi and Bangkok were constructed in the heart of the young delta, the canals of the Ayutthaya period became an integral part of their canal networks. In the Ratanakosin period the extension of the transportation network through canal excavations continued in the tradition of the Ayutthaya period. The series of short-cut canals excavated between Pathum Thani and Phra Pradaeng in the Ayutthaya period and the group of natural waterways around the capital came to constitute the Bangkok outskirts canal system. At the same time, transverse canals were cut linking the Chao Phraya with the rivers to the east and west.

From the reign of King Rama III the waterways rapidly assumed a greater military significance. The confrontation with the Burmese and later with the British colonial power in the Malay peninsula, the administration of the Lao principalities in the Khorat plateau and on the middle reaches of the Mekong, and the conflict with Annam over the sovereignty of Cambodia all required the mobilization of troops and supplies. At the same time it was also necessary to secure transportation facilities for the collection of various taxes and the requisition of goods in order to meet this heavy military expenditure.[12] Thus in 1829 the Sunak Hon canal was dug, linking with the Mahachai canal at Sakhonburi and running westward across the coastal delta flat region to the mouth of the Maeklong river at Samut Songkhram.[13] And in 1837 work began on the Saen Saep (Bang Khanak) canal, a long transverse canal reaching to the Bang Pakong river in the east.[14] Thus the three rivers to the east and west were linked to the central Chao Phraya by man-made canals.

From the reign of King Rama III a further significant change occurred: the employment of Chinese wage labor for the excavation and restoration of canals. From the early nineteenth century, large numbers of Chinese immigrants settled in the capital, and their hired labor provided a more reliable and productive workforce than the

12. Walter F. Vella, *Siam under Rama III* (New York: J. J. Augustin, 1957), p. 24.
13. Chaophraya Thipphakorawong, *Phraratchaphongsawadan krung ratanakosin chabap hosamut haeng chat ratchakan thi 3 ratchakan thi 4* [National Library version of the dynastic chronicles of the third and fourth reigns of the Ratanokosin era] (Bangkok: Samnakphim Khlangwitthaya, 1963), pp. 92–93. (hereafter cited as *PPKR 3,4*)
14. Thipphakorawong, *PPKR 3,4*, p. 179; Wonsanupraphat, *History of the Ministry of Agriculture*, p. 133.

corvée conscription for many public works, particularly canal building.[15] In the reign of King Rama IV (1851–1868) the practice of hiring Chinese labor continued, and long trunk canals were cut through the west bank of the delta. Figure 2 shows the canal system at the end of the fourth reign. From the Bangkok outskirts system several trunk canals reached to the parallel rivers to the east and west. At the junctions of the rivers and the trunk canals were situated such militarily and economically strategic towns as Nakhon Chaisi and Samut Sakhon (Sakhonburi), and at the mouths of the rivers were estuary port towns called *huamuang paknam* which usually had a fortress garrisoned with troops.[16] Thus by the mid-nineteenth century the framework of the waterway system had been laid down, particularly on the west bank.

During the reign of King Rama V (1868–1910), as shown in Figure 3, the construction of the trunk canal system progressed rapidly, mostly from the 1880s, particularly in the young delta on the east bank. Canal networks were also installed in the middle of the young delta, in the lowest lying area classified by Takaya as the delta flat. The canal systems built from the fourth reign in the mid-nineteenth century provided the necessary access to the young delta for land reclamation and the irrigation water necessary for rice-growing.

Even in the Ayutthaya period when rice-growing centered on the floodplain of the old delta, ricelands were irrigated by canal. Water from the swollen rivers of the rainy season inundated the paddy fields through small natural distributary channels and dredged semiartificial channels linked to them. The innumerable small *khlong* in the old delta, both natural and artificially improved, have probably always served to carry the floodwaters onto the fields. Neither were the royal governments of Ayutthaya totally unconcerned with this kind of irrigation in the floodplain. One historical document of the Ayutthaya period records that the official seal of the Ministry of Agriculture (Krom Na) was

15. The hiring of Chinese wage labor for public works began around the time of King Rama II, and became widespread from around the fourth reign. Thipphakorawong, *PPKR 3,4*, p. 436; G. William Skinner, *Chinese Society in Thailand: An Analytical History* (Ithaca: Cornell University Press, 1957), p. 114.

16. Typical *huamuang paknam* are Phra Pradaeng built in the Ayutthaya period and Nakhon Khuankhan built on the opposite bank of the Chao Phraya in the second reign of the Bangkok dynasty. King Rama IV built a fort at Sakhonburi at the mouth of the Tha Chin river, where Mon troops were garrisoned. Chaophraya Thipphakorawong, *Phraratchaphongsawadan krung ratanakosin chabap hosamut haeng chat ratchakan thi 1 ratchakan thi 2* [National Library version of the dynastic chronicles of the first and second reigns of the Ratanokosin era] (Bangkok: Samnakphim Khlangwitthaya, 1962), pp. 505, 692 (hereafter cited as *PPKR 1,2*); Thipphakorawong, *PPKR 3,4*, p. 92.

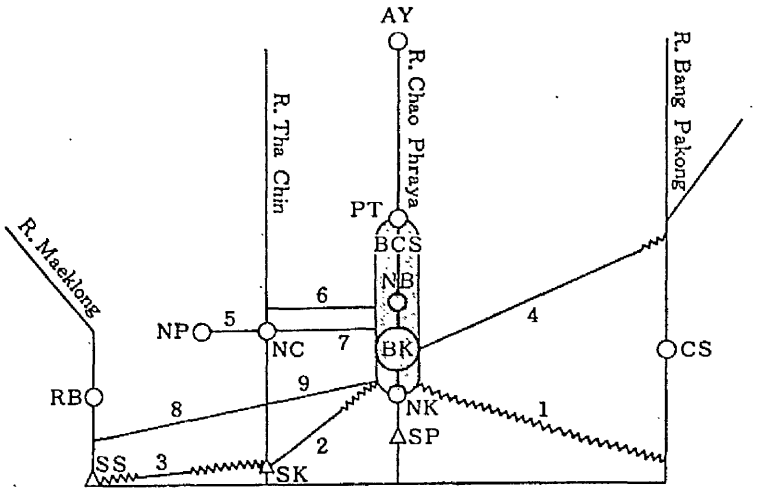


FIG. 2 THE CANAL SYSTEM OF THE LOWER CHAO PHRAYA DELTA IN THE MID-NINETEENTH CENTURY

—— Straight canal course
wwww Winding canal course
----- Boundary of Rangsit canal system
BCS : Bangkok Outskirts Canal System
AY : Ayutthaya
PT : Pathum Thani
NB : Nonthaburi
BK : Bangkok
NK : Nakhon Khuankhan (Phra Pradaeng)
SP : Samut Prakan
CS : Chachoengsao
NP : Nakhon Pathom
NC : Nakhon Chaisi
SK : Sakhonburi (Samut Sakhon)
RB : Ratburi
SS : Samut Songkhram
o : *Krung* (Capital)
o : *Huamuang* (Provincial town)
△ : *Huamuang Paknam* (Fortified rivermouth town)
∘ : *Danphasi Phainai* (Inland-transit customs house)

1 : K. Samrong
2 : K. Mahachai
3 : K. Sunak Hon
4 : K. Saen Saep
5 : K. Chedi Bucha
6 : K. Yong
7 : K. Mahasawat
8 : K. Damnoen Saduak
9 : K. Phasi Charoen
10 : K. Prem Prachakon
11 : K. Nakhon Nuang
12 : K. Prawet Burirom
13 : Four lateral canals
14 : K. Preng
15 : K. Thawi Watthna
16 : K. Naraphirom
17 : K. Rangsit
18 : K. Niyom Yatra
19 : K. Udom Chanchon
20 : K. Luang Phaeng
21 : K. Charoen
22 : K. Phra Rachaphimon
23 : K. Phraya Banru

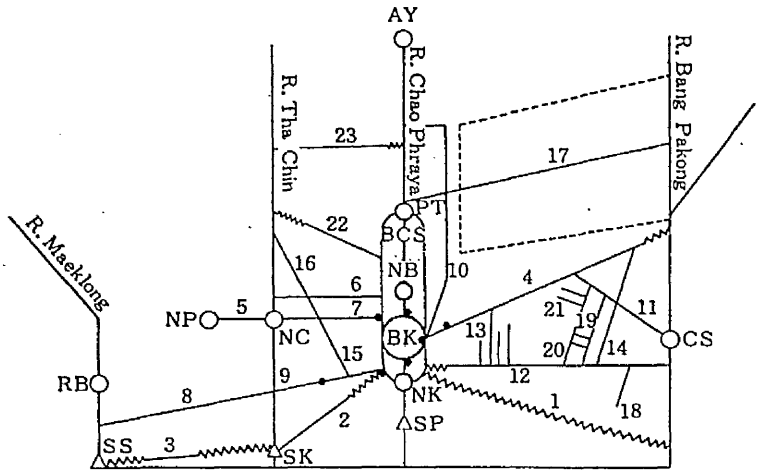


FIG. 3 THE CANAL SYSTEM IN THE LOWER CHAO PHRAYA DELTA AT THE CLOSE OF THE NINETEENTH CENTURY

necessary for the construction of small *khlongs* for irrigation of ricelands.[17] Of course, as Ishii has noted, the degree of involvement of the Ayutthaya state in irrigation was not comparable to that of the Lanna Thai states of the intermontane basins.[18] Most of the irrigation canals in the old delta were developed at the rural community level and consequently were seldom recorded in state documents. State concern, as seen earlier, focused on the development of communications through the construction of large-scale canals.

Even after the transfer of the capital to Bangkok, this tendency to emphasize communication rather than agricultural production in the large-scale hydraulic works changed little. Nevertheless, as in the Ayutthaya period the state maintained a certain level of interest in rice production in the kingdom's granary, the old delta centered on Ayutthaya, where central government ministries such as Krom Na and

17. *Kotmai tra sam duang: Pramuang kotmai ratchakan thi 1 chunlasakkarat 1166 phim tam chabap luang tra 3 duang* [The law of three seals: The collected laws of the first reign in 1805, edited according to the original version with three seals] (Bangkok: Ongkankha khong Khrusapha, 1963), 1: 182. (hereafter cited as *KTS*).
18. For a comparison of irrigation agriculture and the degree of state participation in the Lanna Thai states of the intermontane basins and the delta states, see Shigeharu Tanabe, "Kanchonprathan phua kankaset nai prawattisat setthakit Thai," [Irrigation agriculture in the economic history of Thailand] *Warasan Thammasat* (Thammasat University Journal) 5, no. 2 (1975): 70–94.

provincial governors such as Chao Muang Krung Kao of Ayutthaya directed water management based on detailed correspondence between local officials and the central government. A document of King Rama III dated c.s. 1204 (1842/43) records that any threat to the rice crop due to surplus or shortage of floodwater was reported in detail from Ayutthaya, Ang Thong, Suphanburi, Nakhon Nayok and other places in the old delta, and countermeasures were ordered such as the opening or closing of sluice gates (*thamnop*) or the building of earth dikes for flood control.[19]

In sum, rice cultivation in the old delta in the Ayutthaya and early Ratanakosin periods was, as Ishii has stated, an extremely nature-dependent form of agriculture based on floodwater irrigation, but which involved the digging and improvement of small canals at the rural community level. The state, while consistently concerned to some degree with agricultural production in the granary ricelands, directed its efforts primarily to the provision of communication routes through the excavation of large-scale canals.

RICELAND RECLAMATION FROM THE MID-NINETEENTH CENTURY.

The Early Years

It is frequently stated that following the conclusion of the Bowring Treaty in 1855, during the reign of King Rama IV, the production of rice for export expanded rapidly over the whole Chao Phraya delta in response to the demand from other Asian countries and that a monoculture of rice was established. However, while the conclusion and effectuation of the Bowring Treaty certainly marked the beginning of land reclamation in the wasteland of the young delta, the reclamation was neither rapid nor smooth but was preceded by a gradual progression of events that began after the transfer of the capital to Bangkok in the center of the young delta.

The several long transverse canals cut for military purposes or to facilitate the collection of taxes, and dating back at least to the third reign, meant that parts of the young delta both east and west of the capital were already accessible. Further, the influx of Chinese immigrants, particularly into Bangkok in the fourth reign, contributed significantly to the population increase in the young delta. According to estimates made by Pallegoix and Bowring in 1854–1855, roughly

19. "Ruang kiaokap Krung Kao, tonthi 1" [Concerning Krung Kao, part 1] in *Prachum phonsawadan* [Collected historical sources] (Bangkok: Ongkankha Khong Khrusapha, 1969), vol. 43, pp. 17–29.

half of the population of Bangkok, that is about two million of three or four million people, was Chinese.[20] Earlier, in the third reign, Malloch estimated the Chinese population of Bangkok at about 600,000 to 800,000, again about half of the total.[21] Malloch's estimate of the Chinese populations of provincial towns indicates that the Chinese had not only spread through the old and young deltas but had reached the towns of the outlying provinces.[22]

The Chinese who settled in the provinces during the third and fourth reigns almost certainly engaged in commercial activities, as did Chinese in Bangkok. Other Chinese from the capital were employed in the construction of canals in the young delta. They did not, however, directly carry out the reclamation of ricelands in the young delta. Nevertheless they played important roles in and around the towns of the young delta in the early years of land reclamation. In the Nakhon Chaisi region at the western margin of the delta were sugar mills, each manned by two to three hundred Chinese workers.[23] Malloch's list of exports in 1850 was headed by sugar and sugar products, worth 708,000 baht; sugar also constituted the most valuable export item in the 1850s and 1860s.[24] In the 1870s, however, floods and drought in the Nakhon Chaisi region, coupled with an influx of cheaper Java sugar onto the world market which brought down the world price, led to a rapid decline in the culture and processing of sugarcane under Chinese capital and labor.[25]

In the early years of land reclamation in the young delta there was much trial and error in the selection, processing, and marketing of commercial produce. Many cash crops, such as sugarcane, pepper,

20. Jean Baptiste Pallegoix, *Description du Royaume Thai ou Siam* (Paris, 1854): vol. 2, p. 60; Sir John Bowring, *The Kingdom and People of Siam* (London: Parker, 1857), vol. 1, pp. 85, 394.
21. D. E. Malloch, *Siam: Some General Remarks on its Productions, and Particularly on its Imports and Exports* (Calcutta: J. Thomas, 1852), p. 70.
22. Malloch, *Siam*, pp. 70–71.
23. Pallegoix, *du Royaume Thai ou Siam*, 1: 101–102; Frederick Arthur Neale, *Narrative of a Residence at the Capital of the Kingdom of Siam* (London: Office of the National Illustrated Library, 1852), pp. 68–69.
24. According to Finlayson, sugar production in 1821 was 30,000 piculs (1 picul = 60 kilograms). Neals reports that twenty ships laden with 4,000 tons of sugar set sail for Singapore and Bombay. Ingram states that exports doubled from 107,000 piculs to 204,000 piculs between 1849 and 1859. Malloch, *Siam*, pp. 46–47; Neale, *Residence at Siam*, pp. 68–69, 76; J. C. Ingram, *Economic Change in Thailand, 1850–1970* (Stanford: Stanford University Press, 1971), p. 123.
25. Ministry of Commerce and Communications, *Siam, Nature and Industry* (Bangkok, 1930), pp. 220–221; Wilhelm Credner, *Siam das Land der Tai* (Stuttgart: J. Engelhorns Nachf, 1935), p. 241.

and chillies, were grown in the high dry lands of the margin of the young delta, which were suitable for upland agriculture. This upland cultivation belt stretching westward from Nakhon Chaisi is what Takaya classifies as a fan-terrace complex—and dry-season cultivation of cash crops has flourished there to the present. In the reign of King Rama V, cultivation of upland crops, including sugarcane, expanded, and Chao Phraya Thiphakorawong states that remains in the vicinity of the Phra Pathom Chedi were destroyed by the advance of upland cultivation by Chinese.[26] Even after the decline of sugar exports, sugar mills (*rong hip oi*) operated by Chinese (*longchu*) continued to function. Prince Damrong reported after his inspection of the Nakhon Chaisi region in R.S. 117 (1898/99) that the Phra Pathom Chedi district alone contained seventeen mills which would yield 100 *chang* (8,000 baht) annually in sugar tax.[27]

In the reign of King Rama IV the claiming (*chap chong*) of large tracts of the wasteland of the young delta started, following the excavation of trunk canals on the west bank. These canals were twenty or thirty kilometers long and cost vast sums in wages for the Chinese labor. Although carried out as state public works, these projects were too costly for the impoverished government to finance alone, and capital was sought from other sources. The king, noble officials, and wealthy Chinese all invested huge sums in canal excavations, and as collateral claimed possession of the lands along the canal banks.

The Mahasawat canal, a 27-kilometer trunk canal running westward from the capital and linking with the Chedi Bucha canal at Nakhon Chaisi, was begun in 1857 with the aim of opening a route for transportation of sugarcane, rice, and other produce from the region of Nakhon Pathom and Nakhon Chaisi to the capital.[28] The king himself provided the greater part of the total investment of 88,120 baht, by confiscating the property of Thao Thep Akon Talat who had amassed a fortune through market management in the reign of King Rama III. In the excavation of this canal the king for the first time claimed ownership of vast tracts of wasteland along the canal. This land, covering 16,200 *rai* (2,592 hectares) on the central part of the canal (Fig. 4), was granted to his sons and daughters to hold as ricelands. "The Royal Draft of the Proclamation for the Royal Grant of Land to Princes, and

26. Thipphakorawong, *PPKR 3, 4*, p. 805.
27. Krom Phraya Damrong Rachanuphap, *Eksan truat ratchakan Muang Nakhon Chaisi khong Somdet Phrachao Boromawongthoe Krom Phraya Damrong Rachanuphap mua duan singhakhom R. S. 117* [Prince Damrong's record of his inspection of Nakhon Chaisi district in 1898–1899] Cremation volume of Mom Lamduan Ditsakun na Ayutthaya (Bangkok, 1968), pp. 15–16.
28. Thipphakorawong, *PPKR 3, 4*, pp. 530–531.

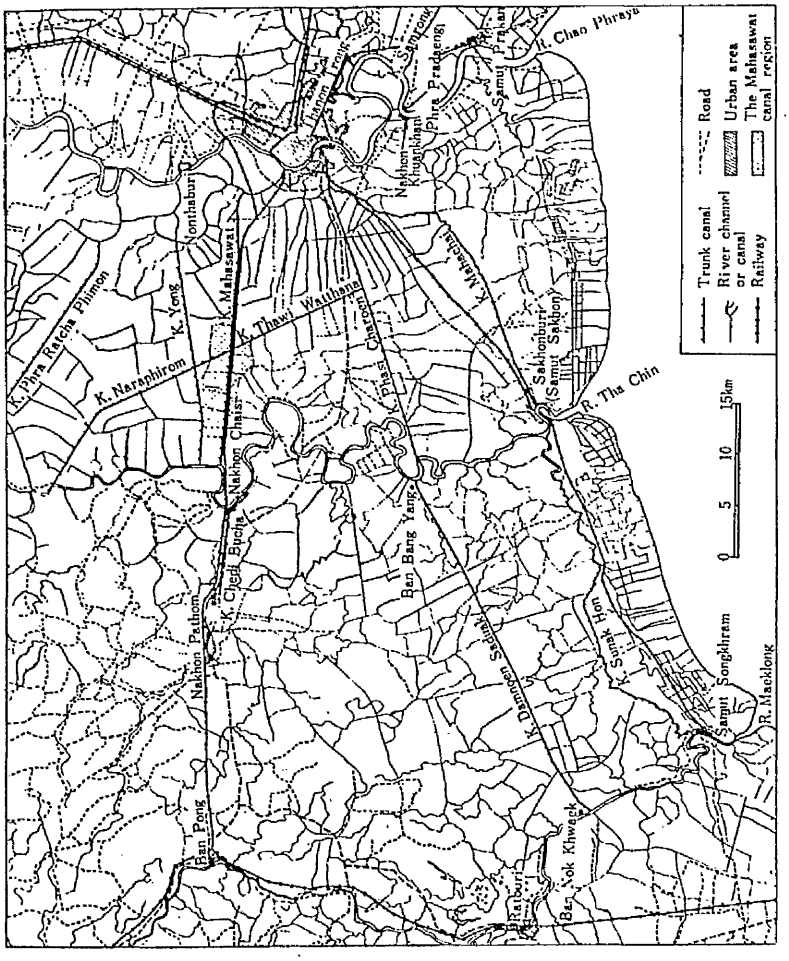
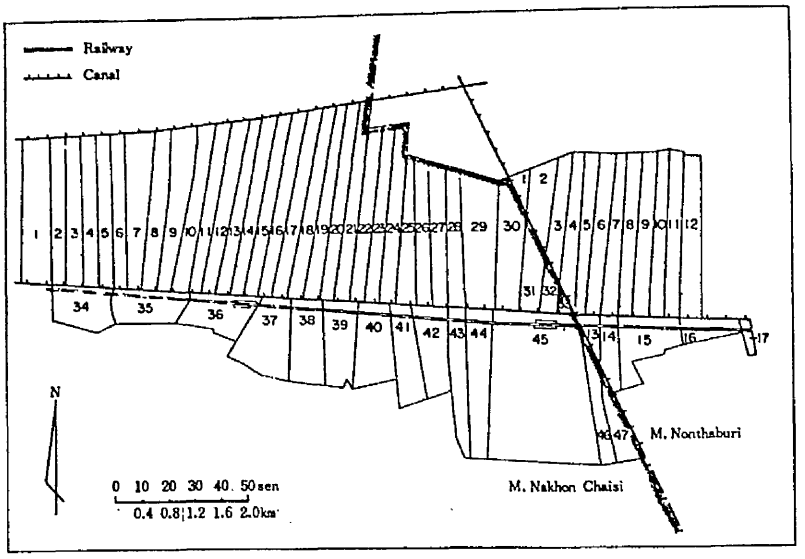


FIG. 4 TRUNK CANALS ON THE WEST BANK

Princesses P.S. 2404 [1861/62]" states: "As there is no landowner, the king is in full possession of this land and will grant some plots to princes and princesses, so that some will get one plot and some will get two. They should be cultivated by *bao phrai* [corvée peasants] or leased to other people. This newly reclaimed riceland is exempt from land tax under the terms of the previous proclamation."[29]

29. "Prakat rang Phraratchahatthalekha phraratchathan na phrachaolukyathoe," [Draft of the royal proclamation concerning grants of riceland to princes] in *Prachum kotmai pracham sok* [Collected laws arranged chronologically] vol. 6 (Bangkok: Nitiwet, 1861), pp. 273–274 (hereafter cited as *PKPS*).



N.C. 30 (Nakhon Chaisi 30) and N. 1 (Nonthaburi 1), N.C. 31 and N. 2, N.C. 32 and N. 3, N.C. 33 and N. 4, N.C. 46 and N. 13, N.C. 47 and N. 14, were each granted to one individual.
Only N.C. 25 and N.C. 29 were held by people other than the sons and daughters of Rama IV. N.C. 25 was granted to a high official by Rama IV, and N.C. 29 was held by an official who was engaged in division of the land by order of the Minister of Finance. The largest plot of land, N.C. 45, belonged to the prince who later became Rama V. The total area granted to sons and daughters of Rama IV was 1,896.66 *rai* (303.47 hectares).

FIG. 5 LAND REGISTER MAP OF THE MAHASAWAT REGION, R.S. 122 (A.D. 1903)

Figure 5 shows the mode of division of this extensive wasteland among the sons and daughters of King Rama IV. In granting this land the king deliberately sought to promote tenancy under the landownership of the royal family. As will be described later, land claimed by the king and granted to the royal family or to noble officials was called *na luang*, or royal riceland, of which the lands on the Mahasawat canal are an early example. Possession of the land adjoining canals was not solely a royal prerogative: a large estate of over 1,000 *rai* (160 hectares) operated by an eminent noble official and employing debt slaves was also reported as lying along this canal by a foreigner in 1884.[30]

30. M. Hardouin, "Voyage à Rátboury et à Kanboury," *Cochinchine Francaise, Excursions et Reconnaisaances* vol. 8, no. 19 (Saigon): 189–203.

The acquisition of unclaimed land along newly dug canals and the operation of large estates, cultivated by corvée peasants and debt slaves under the old system of patron-client relationships, or rented out under the landlord-tenant system, became widespread with the growth of the canal network on the west bank in the young delta.[31] The Damnoen Saduak canal completed in 1868, which linked the Mahasawat canal with the Maeklong river to the west, was reportedly excavated with a huge investment from Somdet Chao Phraya Sisuriyawong (Chuang Bunnak), the Minister of Military Affairs.[32] In fact, this heavy investment, as Rama V wrote in a later letter, was appropriated from the balance of the sugar tax revenue which had been put in Sisuriyawong's charge for construction of a royal palace at Phetburi.[33] Sisuriyawong took full advantage of the project, distributing lands along the canal to his wives, relatives, and dependents, and selling it to others for cultivation. Through this, large landholdings were acquired, similar to those along the Mahasawat canal.

Construction of the Phasi Charoen canal linking the capital with the Damnoen Saduak canal at the Tha Chin river was begun in the reign of Rama IV, reportedly on the appeal of a Chinese opium and sugarcane tax farmer, Phra Phasi Sombatboribun (Pho Jim)[34], and completed in 1872. Phra Phasi Sombatboribun had extended his commercial operations in sugarcane at Don Kradi on the east bank of the Tha Chin river, and proposed the construction to facilitate transportation between his commercial base and the capital.[35] Since the government could not provide the capital, he suggested two methods of financing the project: the collection of a toll on boats using the canal, and the establishment of lottery house at Nakhon Chaisi and Tha Chin for ten years.[36] In addition to inland navigation, Phra Phasi Sombatboribun also evidently had in mind the reclamation of land along the

31. For economic conditions in this period, see Ammar Siamwalla, *Land, Labor and Capital in Three Rice-Growing Deltas of Southeast Asia, 1800–1940*, Discussion Paper no. 150 (New Haven: Economic Growth Center, Yale University, 1972), p. 23.
32. Thipphakorawong, *PPKR 3, 4*, p. 711.
33. Phrabat Somdet Phra Chunlachomklao Chaoyuhua, *Phraratchahatthalekha Phrabat Somdet Phra Chunlachomklao Chaoyuhua mua sadet praphat Monthon Ratburi nai pi raka R. S. 128* [King Chulalongkorn's letters during his trip to *monthon* Ratburi in 1909–1910] Cremation volume of Somdet Phra Phituchachachao Sukhumanmarasi Akkharatchathewi (Bangkok, 1927), p. 2.
34. "Prakat khut Khlong Phasi Charoen," [Proclamation for excavation of the Phasi Charoen Canal] *PKPS*, vol. 7 (1865): 154.
35. Chunlachomklao, *King Chulalongkorn's letters, Ratburi*, p. 2.
36. "Phasi Charoen Canal," *PKPS*, pp. 155–156.

canal. In his proposal he referred briefly but clearly to the levying of a land tax on people who reclaimed and held lands which extended up to six hundred meters from each bank.[37]

These large tracts of land claimed by the royal family, nobility, and wealthy Chinese along the newly dug canals seem largely to have been left uncultivated. Certainly, the wastelands of the young delta were not rapidly developed into ricelands. Concerning the extensive ricelands along the Mahasawat canal granted to princes and princesses, for example, the later report submitted to the throne by Prince Damrong in R.S. 122 (1903/04) contains the following passage:

> "In the early days there were only a few cultivators, and there were vast amounts of wasteland. Although there were a few people who went to cultivate the land, there was not enough labor for the granted area. At first then these lands were in good order, and there was no mutual infringement of land. When prospects for these lands became better after R.S. 115 [1896/97] with the good price for rice, the area filled with peasants to cultivate it."[38]

This passage implies that the large landholdings established along the newly dug canals could not all have been cultivated solely by the corvée peasants and debt slaves of the old system.[39] This then reveals the boundary of the traditional society based on patron-client relationships. Land reclamation on the west bank, which began with the cultivation and processing of sugarcane, had proceeded within the framework of the old society, accompanying the excavation of trunk canals.[40] But the full-scale conversion to riceland of the extensive areas along the canals, which though claimed were virtually untouched and unproductive, had to await the emergence of a free peasant class through the disorganization of the old social system, and at the same time a rise in the rice price.

The Boom in Riceland Reclamation

In the reign of King Rama V (1868–1910) the cultivated area of the young delta expanded considerably, and from the mid-1870s rice

37. "Phasi Charoen Canal," *PKPS*, p. 156.
38. "Ruang thina nai Khlong Mahasawat," [Concerning the riceland along the Mahasawat canal] in Krasuang kasettrathikan [Records of the Ministry of Agriculture], National Archives, Bangkok: 3.3/31 (hereafter cited as *KS*).
39. Dilock Prinz von Siam, *Die Landwirtschaft in Siam* (Leipzig: Verlag von C. L. Hirschfeld, 1908), pp. 96–98.
40. The landlord-cultivator relationship in the traditional society differed from that in the modern landlord-tenant system based on payment of rent.

exports also increased sharply.[41] In the 1870s the state showed greater awareness of the two essential functions of the young delta canals and began to adopt policies for the reclamation of ricelands that hinged on the excavation of canals. Underlining the importance of inland navigation in the existing trunk and Bangkok outskirts canal systems as the key to the conveyance of commercial goods, especially rice, the government implemented a vigorous program of canal maintenance. And in the cutting of new canals to expand cultivated area, the government overcame its financial difficulties through a new policy of exacting part of the expense from the peasants who cultivated lands along the canal and who benefited from irrigation water, in return for which they were granted ownership of the land. This policy aimed at suppressing the acquisition of large landholdings along the canals by members of the royal family and nobility, while promoting expansion of the area actually cultivated. It also sought to increase government revenue from land taxes.

In line with this policy, the "Ten Royal Proclamations on the Administration of Canals" was issued in 1870.[42] It included administrative regulations regarding the fouling and silting up of the waterways, and the obstruction of the navigation lanes by buildings or aquatic plants, and a series of canal navigation laws. Special reference was also made to the importance of the trunk canals dug in the fourth reign, such as the Chedi Bucha, Mahasawat, Phasi Charoen, and Damnoen Saduak canals, for the conveyance of commercial goods. Indeed these waterways were vital to communication in the young delta, where large roads were practically nonexistent.

On the other hand, the fact that the large landholdings acquired by royalty and noble officials in the course of the earlier canal excavations had not yielded a proportionately great increase in rice production posed a serious problem. A passage in "The Regulation of Nakhon Nuangkhet Canal" states the difficulty:

> Previously, when the Prem Prachakon Canal was excavated, noble officials and peasants claimed possession of ricelands as they desired. An agricultural officer issued a title-deed [*bai chong*] to the owner. However, titled officials took possession of plots stretching 30 *sen* [1.2 km] or 40 *sen* [1.6 km] along the canal banks, with areas totalling 1,000 *rai* [160 ha] or 2,000 *rai* [320 ha], which they had

41. Ingram, *Economic Change*, pp. 37–38.

42. "Prakat nai ratchakan thi 5 phraratchabanyat thamniam khlong miyu 10 kho, C. S. 1232," [Proclamations during the fifth reign: ten royal proclamations on the administration of canals] *PKPS*, vol. 8 (1870), pp. 27–38.

> corvée peasants cultivate. But those plots that reached 50 *sen* in length could not all be cultivated. Many of the plots of 40 *sen* or 50 *sen* are left as wasteland. Landless peasants come intending to take possession of these idle lands, but fearing retribution they cannot do so boldly. Such ricelands are left idle, and bear no profit of any sort.[43]

Thus on the Prem Prachakon canal (Fig. 6), built between 1869 and 1870, noble officials again claimed possession of large tracts of land.[44] While policy was being formulated to suppress large-scale landholdings, the digging of the Nakhon Nuangkhet canal from the Saen Saep canal to the granary region of Chachoensao along the Bang Pakong river got under way (Fig. 7). "The Regulation of Nakhon Nuangkhet Canal," issued directly before the completion of the work, stated that 24,000 *rai* (3,840 hectares) of arable land would be created by the excavation, and that after a survey of the ricelands under the direction of the Ministry of Agriculture the land would be distributed to peasants according to their ability to cultivate it.[45]

"The Regulation of Canal Excavation" of 1877 set forth the policy of encouraging the peasants to reclaim ricelands along newly dug canals and effect a real expansion of production, while at the same time bearing part of the excavation costs. The preamble points out the importance of rice production and the magnitude of state expenditure on earlier canal development, and criticizes landownership under the old system as a stumbling block to the expansion of rice production for export:

> In recent years rice has become an importance commodity in our kingdom, it is being shipped abroad, and the exporters have brought to all the people a greater wealth than ever before. Some of our orchard and garden produce have also become items of trade. Nevertheless, the state expenditure has been exceedingly great. . . . In the former canal excavation works the king appointed a chief director [*nai ngan*] who employed a Chinese boss [*thaokae*] to carry out the excavation. The work on even a single canal cost several hundred *chang*. . . . The government has opened large and small canals at its own discretion even in regions with poor water facilities where until now people would not come to cultivate ricelands, gardens or orchards, and has brought canal water to many regions. Such regions are increasing rapidly year by year. However, on the canals built in earlier times noble officials have taken possession of far more land than they need, and left it to grow

43. "Prakat Khlong Nakhon Nuangkhet, C. S. 1239," [Proclamation of the Nakhon Nuangkhet canal] *PKPS*, vol. 9 (1877), pp. 202–203.
44. Ministry of Commerce and Communications, *Siam*, pp. 199–200.
45. "Nakhon Nuangkhet canal," *PKPS*, pp. 202–204.

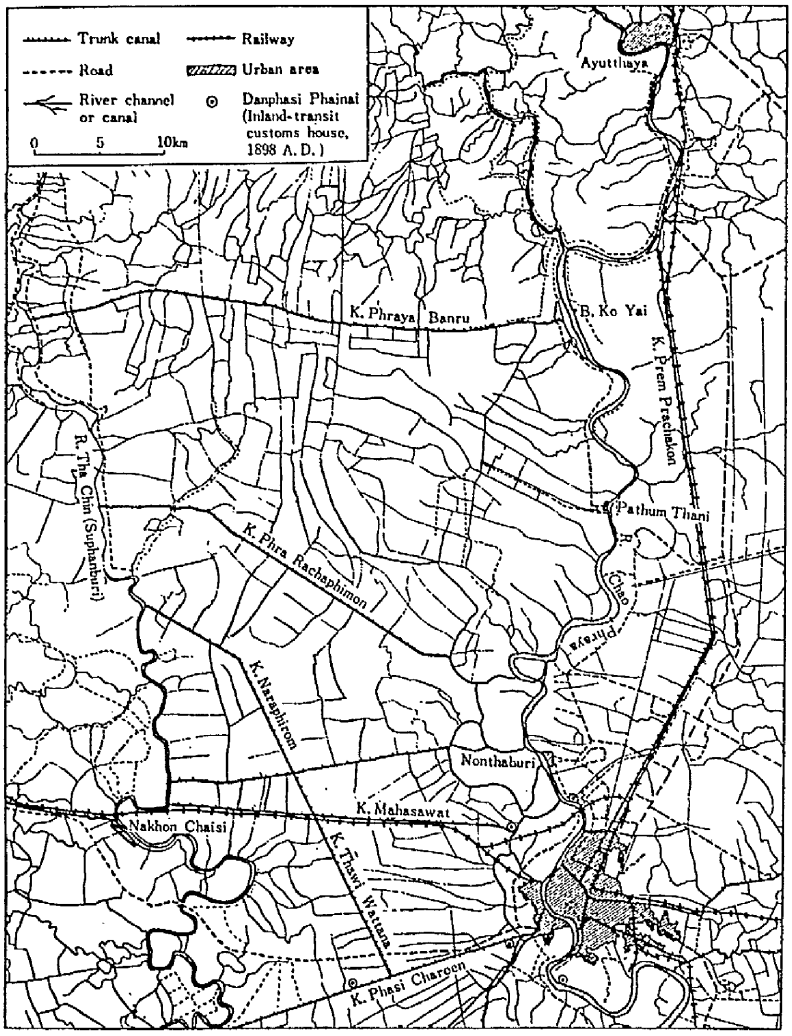


FIG. 6 TRUNK CANALS NORTH OF BANGKOK

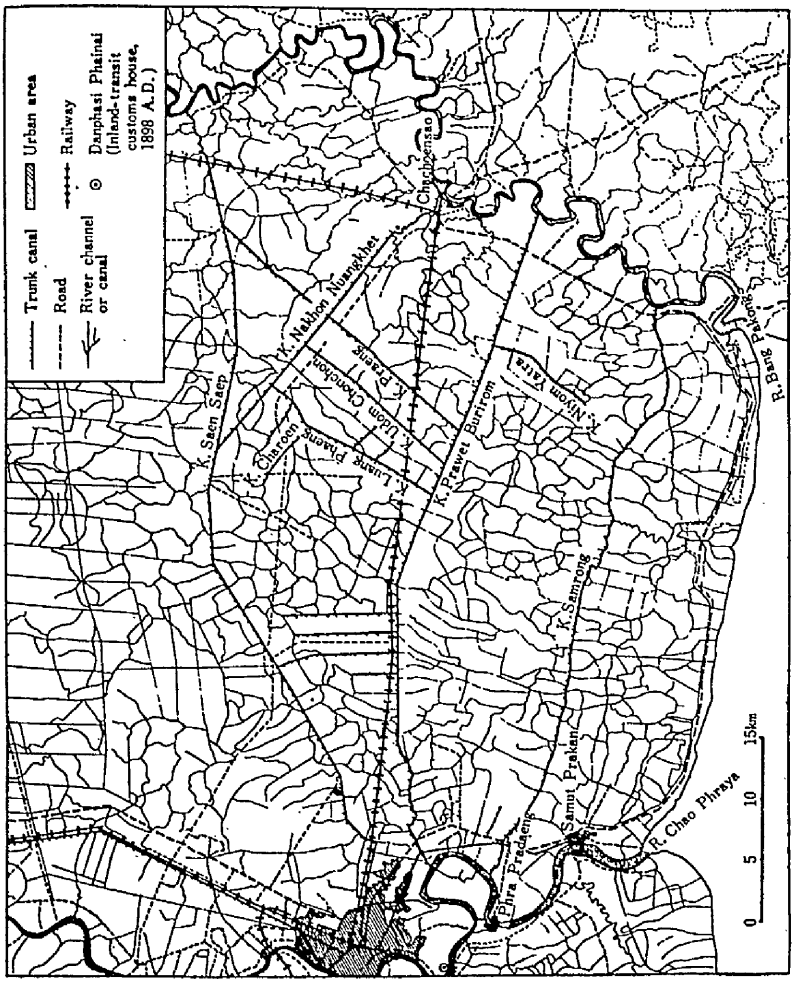


FIG. 7 TRUNK CANALS ON THE EAST BANK

desolate. By not cultivating these lands, they have brought no profit to the king or to the people.[46]

The substance of this regulation was as follows. A special official was to be sent to inspect areas with abundant lands and canal excavation plans were to be made. The lands along the projected canals were to be occupied by peasants and distributed in such a manner that the land value of ricelands, gardens, and orchards would be equal. Individuals occupying lands were to contribute labor or capital to the digging in proportion to the value of the land occupied, lands conveniently situated for transportation at the junction of canal and river being rated higher than those removed from the junction. Further, to encourage land reclamation by the peasants, the validity of the title-deed (*tra chong*) of those who contributed labor or capital was extended from three years to five years, and cultivators were exempted from riceland tax (*kha na*) or garden tax (*kha somphakson*) for three years.[47]

The first canal to which this new reclamation policy applied was the Prawet Burirom canal, which ran from the end of the Phra Khanong canal located south of the capital for a distance of 46 kilometers eastward through the east bank area to join the Bang Pakong river south of Chachoensao. This trunk canal was completed in 1880, at a cost to the government of 83,470 baht in wages for Chinese labor.[48] Four branch canals were also dug from this canal toward the Saen Saep canal, with a view to more effective expansion of arable land. Peasants intending to take possession of lands along these branch canals had to pay a canal fee (*kha khlong*), which varied according to the natural conditions of the land and its location in relation to the market.[49]

The policy of encouraging peasant reclamation of ricelands through application of the canal fee and through tax inducements continued in new canal excavations for some time after. On the east bank

46. "Prakat khut khlong C. S. 1239," [Proclamation of canal excavation] *PKPS*, vol. 9 (1877), pp. 221–225.

47. *Kha somphakson* is generally held to be a tax levied on annual cultivated plants. Bastian claims it is a tax on such upland crops as sugar cane, tobacco, yams, beans, sesame, bananas, vegetables, and maize. Wales states that it differed from *akon suan* (garden tax) in that it was levied only on land actually under cultivation in that year and was thus not a land tax. Unlike *kha na* (riceland tax) which was collected by officials of Krom Na (Ministry of Agriculture), *kha somphakson* was collected by tax farmers. Adolf Bastian, *Reisen in Siam im Jahre 1863, Die Völker des Ostlichen Asiens 3* (Liepzig: O. Wigand, 1867), p. 447; H. G. Quaritch Wales, *Ancient Siamese Government and Administration* (New York: Paragon Book Reprint, 1965), p. 204.

48. Wongsanupraphat, *History of the Ministry of Agriculture*, pp. 140–141.

49. The canal fee was government revenue, part of which paid the salary of local officials.

the digging of the Preng canal was started in 1887. This canal linked the Saen Saep canal with the Prawet Burirom canal, crossing the Nakhon Nuangkhet canal. It served the dual purpose of expanding arable area along its length and of supplying fresh water from the upper reaches of the Bang Pakong river to control salinity in the Prawet Burirom canal in the dry season.[50] Although some of the lands along this canal were granted to princes as *na luang*, others were occupied by peasants who paid the canal fee. On the west bank too, canals were dug. In about 1878 the Thawi Watthana and Naraphirom canals were cut obliquely across the Mahasawat and Phasi Charoen canals to serve as feeders to prevent the silting up of these trunk waterways. At the same time, lands adjoining the new canals were occupied by peasants.[51]

The peasants' situation did not remain so favorable for long, however. From the 1880s the rice price rose steadily, as did the volume of exports,[52] and land prices appreciated sharply in the areas of the young delta with ready access to the capital through the canal system. According to Dilock, though varying from region to region, the rise in land prices was in the order of from one baht per *rai* to eighty baht per *rai*.[53] In the vicinity of Bangkok, in particular, wealthy nobles embarked increasingly upon the speculative buying and renting out of land.[54] The commercialization of land was advancing rapidly, and, in a broad sense, a land market was being formed. This is evidenced by the rising frequency of pawning (*kan khaifak*) and mortgaging (*kan chamnam*) of land.[55] Disputes over land ownership also became more frequent, and private ownership came to be clearly recognized.

At the same time, the government took action that swept away the policy of the 1870s of fostering the peasant cultivators and that introduced a great element of private speculation into the expansion of arable lands along newly dug canals. Instead of undertaking canal

50. Wongsanupraphat, *History of the Ministry of Agriculture*, pp. 145–146.
51. "Prakat poet khlong Thawi Watthana, C. S. 1240," [Proclamation of the opening of the Thawi Watthana canal] *PKPS*, vol. 10 (1878), p. 12; Wongsanupraphat, *History of the Ministry of Agriculture*, pp. 143–145.
52. Ingram, *Economic Change*, pp. 37–38.
53. Dilock, *Die Landwirtschaft*, pp. 99–100.
54. Walter Armstrong Graham, *Siam: A Handbook of Practical, Commercial and Political Information* (London: Moring, 1924), 2:15.
55. Both *khaifak* and *chamnam* were practiced from the late Ayutthaya period. In *chamnam* the debtor deposited the title-deed with the creditor and paid interest while retaining possession of the land. These forms of loan became widespread from the end of the fourth reign in the 1860s. Robert Lingat, *Prawatthisat kotmai thai kotmai thidin* [A history of Thai law: A history of land law] (Bangkok: Thammasat University, 1940), pp. 66–68.

excavation as public works, the government gave concessions to excavate or improve canals to royalty, noble officials, or influential Chinese, or to companies established by them, under a contract agreement. In the case of newly dug canals, the contractor was recognized as owner of the contiguous lands. And since private landownership involved the right to dispose of land, the canal builders were able to make huge profits by sale of the land to peasants. Those undertaking to improve and dredge one of the existing canals were allowed to levy a toll on passing boats and were charged by the government with maintenance of the whole canal. In this way the main body of development of the young delta passed into the hands of wealthy royalty, noble officials, and Chinese, through the wide-ranging increase of private landownership and private management of inland navigation.

In 1888 the Siam Canals, Land and Irrigation Company, whose shareholders were royalty and Chinese, began construction of a canal system and land reclamation in a vast tract of wasteland in the delta flat region to the northeast of Bangkok. In this famous Rangsit canal system, the government contract recognized that all unowned land within forty *sen* (sixteen hundred meters) on either side of the new canals would become the possession of the company from the time of construction.[56] In this way the company was able to sell huge areas of land to royalty, noble officials, and peasants.

The Rangsit canal system comprised a trunk canal, the Rangsit canal, and a lattice of several tens of canals. The Rangsit canal differed from the conventional canals in having lock gates at either end at the junction with the rivers, through which the water level could be controlled and the drainage and irrigation function raised.[57] And the project was not only epoch-making in its technological aspects; historically it was greatly significant in the process of disorganization of the old system, marking the affirmation of landownership of the adjoining lands that led to the development of an extensive new landlord-tenant system aimed at the collection of landrent.[58]

The landlord-tenant system spread rapidly with the development of the young delta from the end of the nineteenth century, as shown by the land disputes that arose in various regions. In the Rangsit canal system in particular, many tenant farmers suffered acutely, and at the start of this century an inquiry into landownership relations in this area

56. "Sanya phraratchathan phraboromaratchanuyat khut khlong P.S. 2431," [Contract granting royal permission to excavate a canal, B.E. 2431] *PKPS*, vol. 11 (1888), pp. 237–244.
57. Van der Heide, *Irrigation and Drainage*, pp. 26.
58. Numerous absentee landlords resided in Bangkok. Thompson, *Lotus Land*, p. 182.

was conducted by the Ministry of the Interior. Its report cites cases of exploitation of tenants by landowners who bought extensive lands along the canals from "the company." Land rent in the first years of cultivation after clearing the land was 1 to 2 baht per *rai*, but as the land was developed this was increased to 4.6 baht per *rai*. The tenant farmers also had to pay the riceland tax, and numerous running expenses, such as for seed rice, draft animals, and wages for employed labor. Frequently they borrowed money from the landowner at extremely high rates of interest. When the crop failed they could not pay the rent or interest, landlords refused to reduce rents, and some tenants simply fled. Further, the diverse origins of the settlers extenuated the practice of traditional customs such as cooperative farm labor and community defense against thieves.[59]

Contemporaneously with the construction of the Rangsit canal system, land reclamation proceeded widely in the young delta, through contracted canal excavations. On the east bank, development was comparatively late and progressed through extension of the existing trunk canal system. The previously inaccessible wastelands of the delta flat region, where rice-growing had been completely impossible, and the coastal belt were the last areas to be reclaimed. In these regions, which include the Rangsit area, land reclamation was highly speculative.

In the 1880s and early 1890s, the Niyom Yatra, Udom Chonchon, Luang Phaeng, Charoen and other canals were dug on the east bank with private capital under contract from the government, and the investors gained ownership of the land adjoining the canals.[60] Canals were also dug in the low swampy wasteland of the delta flat that extended to the west bank, such as the Phra Ratchaphimon and Phraya Banru canals started in the 1890s.[61]

The rush to develop the young delta continued until around the

59. "Ruang Phuak lao mai long ma tham na nai Thung Luang lae ruang khon ophayop ok chak Thung Luang" [Concerning Lao people never coming to cultivate the fields of Thung Luang and leaving Thung Luang], *KS*: 3.1/11.
60. "Prakat Krom Na, P.S. 2433" [Proclamation of the Ministry of Agriculture] *PKPS*, vol. 12 (1890), pp. 18–20; Wongsanupraphat, *History of the Ministry of Agriculture*, pp. 148–154; "Ruang kho anuyat khut khlong tambon tangtang R.S. 108" [Concerning permission for canal excavations in various tambon, R.S. 108] *KS*: 9.2/3.
61. "Ruang Phra Ratchaphimon kho anuyat khut khlong Tambon Thung Bang Bua Thong pai ok Thung Bang Pla Phasi riak wa Khlong Ratchaphimon R.S. 109–113" [Concerning Phra Ratchaphimon's application for permission for canal excavation from Thung Bang Bua Thaong to Thung Bang Pla Phaso, the Rachaphimon Canal, R.S. 109–113], *KS*: 9.2/7; "Ruang rao phu thi kho nauyat khut khlong tangtang R.S. 117–118" [Accounts of applications for permission to excavate canals], *KS*: 9.2/18; Wongsanupraphat, *History of the Ministry of Agriculture*, pp. 141–142.

turn of the century. The capital accumulated by the noble officials and influential Chinese seems to have been insufficient, however, because some of the speculative projects were abandoned unfinished. To some extent this point reflects the immaturity at the end of the nineteenth century of the national economy that was based on the monoculture of rice.

THE DEVELOPMENT OF ROYAL RICELAND (*NA LUANG*)

The Origins of Royal Riceland

Between the late nineteenth and early twentieth centuries canal excavations proceeded rapidly following the legal confirmation of private ownership of adjoining lands. In addition to the development of private landownership which accompanied these excavations, another kind of land tenure was growing. This involved land which the king or the royal household administered directly or which the king granted temporarily to royalty or noble officials for their administration. This land was generally called *na luang*, or royal riceland. The process of incorporation of *na luang* into the royal demesne has hitherto drawn little attention, although it provides an important key to the understanding of the patrimonial elements in the modern Thai land tenure system.

Royal ricelands still exist today. On August 26, P.S. 2518 (1975), King Phumiphon granted approximately 50,000 *rai* (8,000 hectares) of paddy land and 327 *rai* (52.3 hectares) of gardens from the royal demesne (*thidin sapsin suan phramahakasat*) to peasants, and ordered the government to carry through land reforms as a contribution toward peasant relief.[62] The greater part of the *na luang* scattered through the delta has, from last century, been leased to individual peasants, and its management and operation has been entrusted to the Bureau of the Crown Property (*samnakngan sapsin suan phramahakasat*). Previously the peasant tenants paid rent through the Bureau of the Crown Property, but under the land grant the peasants were to be exempted from rent payment. Instead the government was to pay the land rent into a fund to establish farm cooperatives for the peasants who cultivated the *na luang*.[63]

At present, when numerous contradictions are appearing in the modern Thai land tenure system, this granting of *na luang* has, apart from raising the question of what effect this measure can have on overall

62. According to newspapers of August 27, 1975, for example, *Prachathippatai*, *Prachachat*.
63. These *na luang* were mostly in *changwat* Ayutthaya, Prachinburi, Chachoensao, Nakhon Hayok, and Pathum Thani.

land policy, brought clearly into focus the existence of patrimonial landholdings, the *na luang* that remain in the various regions.

How did the *na luang* arise? In considering their origins, important indicators are afforded by the ethnographic descriptions of the traditional land systems of the various Tai peoples inhabiting the intermontane basins between the northern Indochina peninsula and Southwest China. Scattered along the river systems of southwest Yunnan, northern Laos, the Burmese Shan States and the Tonkin highlands of northwest Vietnam are many tribal domains and more politically integrated principalities of Tai peoples. These "tribal Tais" have long traditions of land redistribution. The many ethnographical reports on these regions indicate that landownership of the whole domain rests nominally with the chieftain or ruler, and that ricelands are customarily divided at the village level.

In the Shan States, such as Muang Nai and Hsenwi, the village headmen redistribute the ricelands annually.[64] The Tai Khao (White Tai) of the Tonkin highlands also have a system of periodic repartition of ricelands,[65] while the White Tai of Muang So distinguish two types of land: public land, owned by the domain chieftain (*chao muang*) and repartitioned every three years according to the size of each household, and private land granted by the chao muang.[66] Among the Tho, who also inhabit the Tonkin highlands, some lands were granted to nobles by the chieftain, while in the villages ricelands were redistributed every three years.[67] Among the Tai Daeng (Red Tai) of Thanh Hoa in Vietnam, the autocratic *thoti* held title to all land, which he granted to chiefs and influential families of each village. In return they were obliged to pay land rent and offer labor. Ricelands were not divided at fixed intervals, but only when a new household was established or newcomers arrived in the village.[68]

The traditional land tenure systems of these Tai ethnic groups are distinguished by the fact that landownership rests solely with the chieftain or ruler, the peasants having absolutely no ownership rights. Lingat notes this characteristic, and states that the peasants receive usufructary

64. Erik Seidenfaden, *The Thai Peoples* (Bangkok: The Siam Society, 1967), p. 36.
65. Maurice Abadie, *Les Races du Haut-Tonkin de Phong-Tho à Lang-Son* (Paris: Société D'éditions Géographiques, Maritimes et Coloniales, 1924), p. 71.
66. Frank M. Lebar, G. C. Hickey and J. K. Musgrave, *Ethnic Groups of Mainland Southeast Asia* (New Haven: Human Relation Area Riles Press, 1964), p. 224.
67. Lunet de Lajonquier, *Ethnographie de Tonkin Septentrional* (Paris, 1906), pp. 165–180.
68. Charles Robequain, *Le Than Hoa, étude géographique d'une province Annamite* (Paris: Les Editions G. van Oest, 1929), pp. 148–151.

rights in return for labor offered to the chieftain.[69] The land division traditions can be considered as the distribution of usufructs over lands of a public nature but owned exclusively by the chieftains. Further, in the principalities with more complex social stratification, the tradition is manifested in the granting of lands to the nobility who administer the principality, the size of the grant according with the official post or ranking of the holder. However, as more of these posts and rankings are becoming hereditary so also is land tenure.

These characteristics of land tenure traditions in the principalities were also noticable in the preliberation society of the Lŭ in what is now the Yunnan Shih-shuang pan-na Tai Autonomous Chou. According to Chen's survey in the Sip Song Panna in 1940, lands were divided into four categories: *na woan*, village ricelands held communally by the village, and subject to redistribution; *na chao*, royal ricelands granted to officials; *na wat*, temple ricelands; and *na boi*, newly opened ricelands, of which permanent tenure was recognized.[70] What is remarkable is that the royal ricelands constituted 65 percent of the arable land of the sixty-six villages of the Sip Song Panna and was divided out within each village and cultivated by all corviable villagers. It included *na nai*, royal lands administered directly by the ruler, and the general *na chao*, which was granted by the ruler to officials in accordance with their posts.

In his preliberation survey of the Sip Song Panna, Bunchuai also recorded the existence of royal riceland, which he called *na luang pracham tamnaeng* (royal riceland belonging to officials), or simply *na luang*.[71] The greater part of the royal ricelands was divided among and cultivated by the peasant households in each village, and about 34 percent of the harvest was paid as landrent to the ruler or to the noble officials. The peasants who cultivated the royal ricelands were also required to perform miscellaneous services, being drafted for a diversity of official tasks based on a regional and functional division of labor between the villages. The royal ricelands thus played the central role in a system of twofold exploitation: corvée service and landrent.

69. Lingat, *History of Thai Law*, pp. 11–12. Tomosugi has summarized the land tenure systems among tribal Tais. Takashi Tomosugi, "Tai tochiseidoshi noto" [A note on the historical development of land system in Thailand] in Tsutomu Takigawa and Hiroshi Saito, eds. *Ajia no tochiseido to noson shakai kozo 2* [Land tenure in Asian villages, part 2] (Tokyo: the Institute of Developing Economies, 1967), pp. 62–69.
70. Chen Han-seng, *Frontier Land Systems in Southernmost China* (New York: Institute of Pacific Relations, 1949), p. 32.
71. Bunchuai Sisawat, *Thai Sipsong Panna* [Thai people in the Sipsong Panna] (Bangkok: Samnakphim Khlangwitthaya, 1954), 1:108.

In the thirteenth century, the Lanna Thai and Sukhothai kingdoms rose to power in the intermontane basins of North Thailand and the fan-terrace complexes that adjoined the delta. However, it is not until the Ayutthaya dynasty (1350–1767) that available historical materials mention, and then only briefly, matters pertaining to royal ricelands and land tenure systems.

In the Ayutthaya and early Ratanakosin periods the peasant population was small and vast areas of the arable land of the delta on which the capitals were located were uncultivated. Nevertheless, the title to all lands rested with the king, and the peasant rice cultivators were obliged to pay landrent *kha na* (*akon hang khao*), which was collected by the Ministry of Agriculture. In addition a characteristic system of corvée labor evolved that embraced the whole peasant population. Here, however, I wish to consider the nature of the system of royal ricelands of the king and the patrimonial bureaucracy.

Relevant to this is the grading of the royal family and bureaucrats prescribed by the Law of Civil Hierarchy and the Law of Military and Provincial Hierarchies, legislation thought to date from the reign of King Boromatrailokanat (1448–1488 A.D.).[72] The *sakdina* system of grades (*rabop sakdina*) defines the hierarchical relations of status in the traditional Thai bureaucracy by laying down office (*tamnaeng*), rank (*yot*), honorific title (*ratchathinnanam*), and allotment of *sakdina* for each individual from the vice-king (*maha uparat*) and royal family down to the lowest official. *Sakdina* were expressed as number of *rai* (1 *rai* = 0.16 hectare), from ten thousand for the vice-king down to ten to twenty-five for corvée peasants (*phrai*), and five for slaves (*that*), and beggars (*yachok*). However, there is virtually no evidence to suggest that the *sakdina* land was in practice granted. The fact that slaves and beggars were allotted five *rai* strongly suggests that *sakdina* lands were not granted but rather that the system was a strict numerical prescription of gradations of status.[73] The *sakdina* system itself can nevertheless be thought to be a

72. *KTS*, 1:218–327; Yoneo Ishii, Osamu Akagi, Shigeharu Tanabe, *An Index of Officials in Traditional Thai Governments, vol. 1, part 1, The Law of Civil Hierarchy and The Law of Military and Provincial Hierarchies*, Discussion Paper No. 76. (Kyoto: The Center for Southeast Asian Studies, 1974).

73. Theories concerning the allotment of *sakdina* are diverse but can be summarized as follows. Prince Damrong states that the *sakdina* shows the maximum area of land tenable. Krom Phraya Damrong Rachanuphap, *Phraratcha phongsawadan chabap phraratchahatthalekha* [The orthograph version of the dynastic chronicle] (Bangkok: Samnakphim Khlangwitthaya, 1973), pp. 457–458. Wales believes that *sakdina* originated with the change from territorial feudalism to a feudalism based on control of the manpower of corvée peasants (*phrai*). He theorizes that an official with a *sakdina* of say four hundred would be able to control sixteen *phrai* with *sakdina* of

fictitious reflection of the customs of land redistribution and granting of royal ricelands in the basic culture of the various Tai ethnic groups in the principalities of intermontane basins from southwest China to the northern Indochina peninsula.[74]

Did *na luang*, lands administered by the king himself or by appointed members of the royal family or bureaucratic nobility, exist in the Ayutthaya and early Ratanakosin dynasties? Although *na luang* is rarely mentioned in historical documents, all state territory was in principle *na luang*.[75] In this period the patrimonial state ownership of land was nominally recognized, based on the affirmation of the monarch's title to all state territory and the denial of peasants' rights, but in practice the peasants were usufructaries able to sell and devise their lands. A riceland tax (*akon hang khao*) was levied by the Ministry of Agriculture, which, apart from a period in the reign of the Ayutthaya king Phra Narai, was collected in kind until the third reign of the Ratanakosin era. Basically, peasants were obliged to contribute two *thang* (about forty liters) of paddy per *rai* to the royal warehouses (*chang luang*) in the capital and the provinces, and in addition to sell rice to the government at an official price of six *satang* per *thang*, about half of the market price.[76]

Royal ricelands in this broader sense then were administered by the state. Nevertheless the partial infiltration of the commercial economy

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twenty-five, and that *sakdina* were essentially dignity marks. Wales, *Ancient Siamese Government*, pp. 49–50. Through investigation of precedents in *Kotmai tra sam duang* [The law of three seals], Khachon concluded in the face of current theory that *sakdina* were actually granted. He states that the *sakdina* number showed the various stages in fulfillment of legal duties and exercise of legal rights of those having that number. Khachon Sukhaphanit, "Thanandon phrai," [The status of the corvée peasants] *Prawatthisat lae kanmuang* [History and Politics] (Thammasat University, 1973), pp. 115–120. Lingat relates the origin of *sakdina* with the land division traditions of the tribal Tais and the process of change from communal land tenure customs to the subsequent patrimonial system. Lingat, *A history of law*, pp. 18–19.

74. Lingat, *A history of law*, pp. 18.

75. Clear evidence that the king held title to all lands in the early Ayutthaya period is found in the following well-known entry in *Phra ayakan betset* [The miscellaneous laws] of B.E. 1903 (1360): "The territory belonging to the capital of Ayutthaya is the possession of the king. The peasants, who are servants of the land [*kha phaendin*], can on no account take it as their own". *KTS*, 3:115.

76. Krom Phraya Damrong Rachanuphap, *Tamnan phasi akon bangyang kap khamathibai khong Phrachao Boromawongthoe Krom Phra Damrong Rachanuphap* [A history of some taxes and Prince Damrong's explanation] Cremation volume of Momchaojing Satchan (Bangkok, 1923), pp. 1–7. Chit Phumisak, *Chomna sakdina thai* [Profile of the *sakdina* system of Thailand] (Bangkok: Chomrom Nangsu Saengtawan, 1974), pp. 257–259.

through the royal trade monopolies in primary products, particularly rice, allowed the sustained abuse of the old system which hinged on land taxation and the corvée system. By using their clients (*phrai som*), royalty and noble officials were able to, and did, accumulate lands, particularly around the capital where water resources were good. Naturally, the king also acquired a royal demesne, and in the seventeenth century, de la Loubère reports that the king administered extensive agricultural estates in the vicinity of the capital which were worked by corvée laborers and slaves.[77] This then was the origin of *na luang* in the narrower sense, the royal lands controlled directly by the king.

Expansion of *Na Luang* in the Fifth Reign

The greater part of the lands today held by the king and members of the royal family were acquired during the development of the delta canal system in the late nineteenth and early twentieth century and are referred to as *na luang* in such documents as the Krom Na records of the fifth reign. These royal ricelands in the narrower sense, which grew mainly in the fifth reign, were owned by the king and cultivated by *phrai luang*, clients attached to the king under the supervision of various ministries (*krom*), and the harvest was delivered to the royal warehouses (*chang luang*). However, with the disorganization of the corvée system and the confirmation of the landownership rights of the peasants at the end of the nineteenth century, *na luang* came to be rented to peasants who paid a farm rent (*kha chao*).

Royal ricelands were also granted to members of the royal family and provided their means of support. In principle the tenure of these lands lasted only for one generation, but in practice the land tended to be devised. In a few instances *na luang* was granted in response to a direct appeal (*dika*) from nobles claiming difficulty in making a livelihood. In these cases the grantees were often lower-grade officials who were close to the king, and they were permitted to hold the land while they continued in office.

Most of the royalty who received grants of *na luang*, particularly in the fifth reign, were financially distressed. During the development of the delta in the late nineteenth century, many of the royal family and official dignitaries, with their background of privilege and resources, financed the canal excavations and received lands, or subsequently bought lands along the canals, and administered estates cultivated by corvée peasants. But the disorganization of the old social order supported by the corvée system, and the rapid intrusion of the commercial

77. De la Loubère, *The Kingdom of Siam*, 2:417.

economy left many nobles without means of support. And during the period of greatest upheaval in Thai society, the granting of *na luang* seems to have served principally as a relief measure for distressed nobility.[78]

Figure 8 shows the location of *na luang* recorded in documents mainly of the Ministry of Agriculture in the fifth reign, details of which are listed in the Table 1. The documents record disputes over ownership of *na luang*, disputes between *nai kong*, the agents charged by the royal landowners with the administration of *na luang* including the collection of farm rents, and petitions for grants of *na luang*. Although the documents do not present a comprehensive picture of *na luang* in the fifth reign, they show in outline the regional distribution and area of the principal *na luang*, the circumstances under which the land was granted, and the way it was administered.

The regionality of development of peasant migration and rice cultivation in the upper reaches of the delta was not, as is often stated, uniform. The natural levees and backswamps of the old delta between Chai Nat and Ayutthaya had long been settled, but deep-water zones known as the "arms of the delta,"[79] on the left bank of the Chao Phraya to the north of Ayutthaya and on the right bank to the west, were virtually neglected until the fifth reign. In particular, peasant migration to the deep-water zone south of Phakhai and Sena on the Noi River, a westerly distributary of the Chao Phraya, probably did not occur until during the fifth reign. The collected letters of King Rama V, who often visited the region of Ayutthaya and Anthong, record his astonishment at the rapid development of peasant settlements and rice cultivation in the Phakhai area.[80]

78. On the formation of the modern land tenure system, the limits of the patrimonial system and the general character of royal riceland, see Atsushi Kitahara, "Tai ni okeru tochichoyuken no kakutei" [Confirmation of landownership in Thailand] in Hitoshi Saito, ed., *Ajia tochi seisaku ron josetsu* [Introduction to land policy in Asia] (Tokyo: Institute of Developing Economies, 1976), pp. 261–278.
79. See chapter 7 herein.
80. The writings of Rama V contain reference to the rapid migration of peasants to the Noi river area around 1900. Phrabat Somdet Phra Chunlachomklao Chaoyuhua, *Phraratchatatthalekha ruang sadet praphat Lamnam Makhamthao lae phraratchakrasae ruang chat kanthahan Monthon Krungthep nai ratchakan thi 5* [Royal letters of a visit to the Makhamthao river and royal comments on military reorganization in *monthon* Krungthep in the fifth reign] Cremation volume of Somdet Phrachao Boromawongthoe Chaofa Boriphatsukumphan Krom Phra Nakhon Sawan Phinit (Bangkok, 1950), pp. 26, 30–32; idem, *Phraratchahatthalekha khrao sadet monthon fai nua nai ratchakan thi 5* [King Chulalangkorn's letters during his trip to Northern *monthon*] On the occasion of the sixtieth birthday of Chaochom Manda Homot (Bangkok, 1922), pp. 1–2.

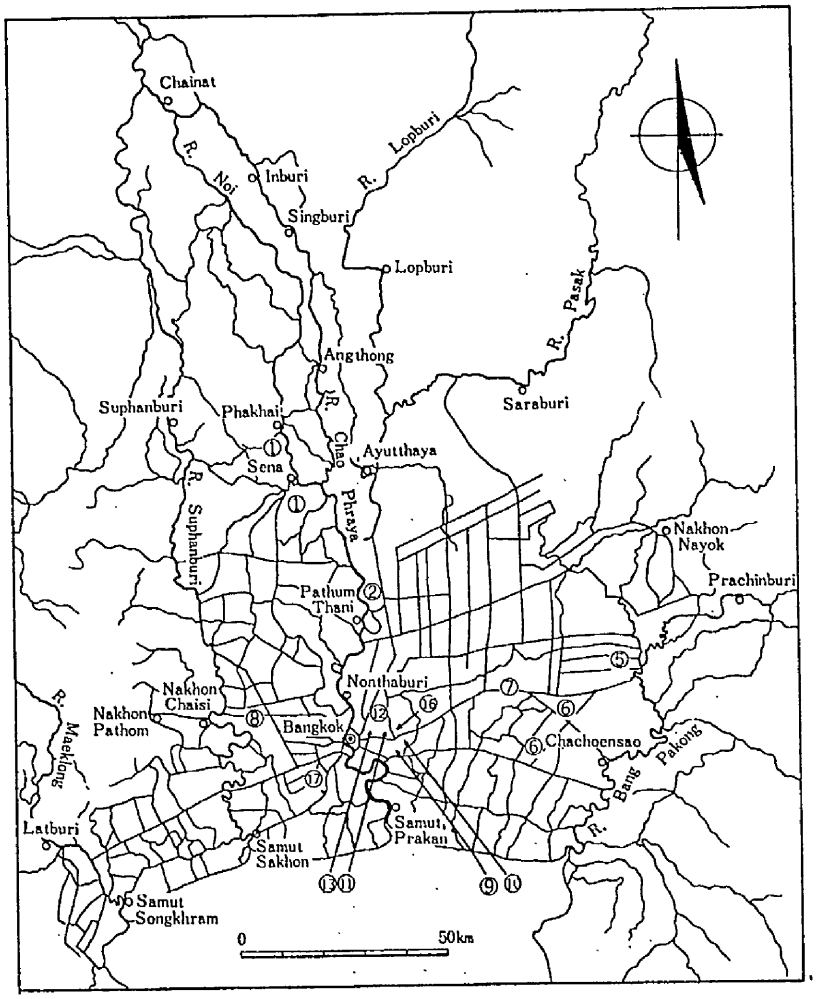


FIG. 8 ROYAL RICELANDS OF THE FIFTH REIGN OF THE RATANAKOSIN DYNASTY

The numbers correspond to those in Table 1.

TABLE 1. ROYAL RICELANDS APPEARING IN DOCUMENTS OF THE MINISTRY OF AGRICULTURE IN THE REIGN OF RAMA V

No.	*Monthon	Village	Grantee	Jurisdiction	Year R.S. (A.D.)	Area in Rai	File No.
1	Krung Kao	Sakae Khanomchin	Proposed royal grant to Prince Wachirawut	Phraya Kasetraksa Phraya Chaiyawichit	109 (1890)	ca. 67,500	KS3.3/2, KS9.2/2
1	Krung Kao	11 villages in Krung Kao	Front Palace (Phrarat-chawang Bowon)	Phraya Kasetraksa	112 (1893)	4,589.00	KS3.3/5
		Bang Jitho				1,508.75	
		Lat Nga				60.50	
		Du Mon				341.00	
		Wat Won Chet				141.00	
		At So				264.00	
		Chao Chet				160.00	
		Wat Yom				84.00	
		Pak Kran				414.00	
		Khanomchin				916.75	
		Khlo				199.00	
		Chang Lek				500.00	
2	Krung Kao	†Phrao in Pathum Thani	Front Palace	Phraya Kasetraksa	112 (1893)	315.00	KS3.3/5
1+2	Krung Kao	13 villages in Krung Kao	Front Palace	Transferred from *Krom Na* to *Krom Phra Khlang Khangthi*	119 (1900)	5,793.50 ††(5,640.00)	KS3.3/26
3	Krung Kao	Uncultivated royal ricelands of seven villages in Krung Kao	Front Palace	Transferred from *Krom Na* to *Krom Phra Khlang Khangthi*	119 (1900)	20,158.00	KS3.3/26

Table 1 (Cont.)

No.	Monthon	Village	Grantee	Jurisdiction	Year R.S. (A.D.)	Area in Rai	File No.
4	Prachinburi	2 villages in Prachinburi	?	Transferred from *Krom Na* to *Krom Phra Khlang Khangthi*	119 (1900)	9,963.425 ††(9,674.00)	KS3.3/26
5	Prachinburi	Bang Khanak in Chachoensao	Phraya Surenthora's donation of wastelands formerly possessed by Chao Phraya Bodin	*Krom Phra Khlang Khangthi*	109 (1890)	ca. 5,000	KS4.4/2
6	Prachinburi	West bank of the Preng canal in Chachoensao	Three applications by royalty and officials for royal grants of a total area of 7,666 *rai*	Luang Phaeng, a canal executer	113 (1894)	19,357.80	KS3.3/8
7	Prachinburi	Sala Daeng in Chachoensao	Front Palace in Rama IV's reign; thereafter granted to Prince Phanumat	Owned by Front Palace royalty and administered by Malay agents	111 (1892)	ca. 3,388	KS3.3/3
8	Nakhon Chaisi	Mahasawat canal region in Nakhon Chaisi and Nonthaburi	Princes and Princesses of Rama IV in 1861	Privately owned by royalty	122 (1903)	17,856.95	KS3.3/31
9	Krung Thep	Sisamak	Front Palace	Transferred from Front Palace to *Krom Chang* in 1892	112 (1893)	ca. 1,700	KS3.3/5
10	Krung Thep	Saen Saep	Application for royal grant by Luang Lokthip				
11	Krung Thep	Khlong Chan	Application for royal grant by Luang Lokthip *Na Khao Phrakraya*	*Krom Chang*	112 (1893)	?	KS3.3/5

12	Krung Thep	Bang Khen	?	*Krom Chang*	112 (1893)		?	KS3.3/5
13	Krung Thep	Sa Pathumwan	?	*Krom Chang*	112 (1893)		?	KS3.3/5
14	Krung Thep	Wat Bampheng	Front Palace	*Krom Chang*	113 (1894)		?	KS3.3/5
15	Krung Thep	Huaphai	200 *rai* granted to Luang Lokthip. Application for royal grant by other royalty	*Krom Chang*	117 (1898)	ca.	1,208	KS3.3/5
16	Krung Thep	Luam O (Bang Kapi)	Application for royal grant by Phra Nomchan	*Krom Chang*	114 (1895)		370.00	KS3.3/1
			Application by Luang Lokthip *Na Khao Phrakraya*		112 (1893)			KS3.3/5
17	Krung Thep	Bang Bon	Granted to Prince Sudarat; after his death granted to 2 princes	*Krom Phra Khlang Khangthi*	119 (1900)	ca.	1,100	KS3.2/32

*Old administrative unit comprising several provinces.
†Although around 1893 Pathum Thani was administered as a town within *Wong Ratchathani* under the jurisdiction of the Ministry of the Metropolis (Krasuang Nakhonban), royal ricelands in Phrao were included with those of Krung Kao under the direct management of Phraya Kasetraksa.
††Surveyed by the Ministry of Agriculture in 1900.

In R.S. 109 (the 109th year of the Ratanakosin Era; A.D. 1890/91) the governor of Krung Kao (old capital of Ayutthaya) and an official of the Ministry of Agriculture in charge of *na luang*, Phraya Kasetraksa, proposed that the king should take possession of some 67,500 *rai* of wilderness around the villages of Sakae and Khanomchin as *na luang* for Prince Wachirawut (who became Rama VI in 1910). The land in question was the undeveloped deep-flooding plain south of Sena, further downstream from Phakhai.[81] It is doubtful whether the proposal was implemented as it stood; but the survey conducted three years later in R.S. 112 (1893/94) by Phraya Kasetraksa revealed a total of 4,909 *rai* of *na luang* in eleven villages in *monthon* Krung Kao and one village in Pathum Thani province. This represents the area of *na luang* rented to tenant farmers from whom farm rent was collected; in addition a large expanse of as yet uncultivated wilderness had been claimed as *na luang*.[82]

Documents of R.S. 112 record that the *na luang* which Phraya Kasetraksa proposed be granted to prince Wachiraut were attached to the Front Palace (*Wang Na*) of the vice-king (*na luang fai Phraratchawang Bowon* [*Sathan Mongkhon*]). How this *na luang* became attached to the vice-king, however, is not recorded in the Ministry of Agriculture's documents. It is possible that the death of Vice-king Wichaichan and the attendant abolition of the position of vice-king in R.S. 105 (1886/87) left many of the royalty dependent on the vice-king without means of support,[83] and that the *na luang* in question in the proposal of four years later was subsequently granted for the upkeep of the Front Palace royalty.

81. "Ruang na Bang Sakae Khwaeng Krung Kao Phraya Phatsa khit cha yokhai Chofa Mahawachirawut" [Concerning the riceland of Bang Sakae in Krung Kao region, which Phraya Phatsa intended to reserve for Chaofa Mahawachirawut], *KS*: 3.3/2.
82. "Ruang Luang Lokthip Khun Thepyakon kho rap phraratchathan thina luang Tambon Saen Saep Huamak Khwaeng Krung Thep" [Concerning Luang Lokthip and Khun Thepyakon's application for royal grant of riceland in Tambon Saen Saep and Huamak in Krung Thep region], *KS*: 3.3/5.
83. Krom Phraya Damrong Rachanuphap, *Tamnan wang na* [A history of the Front Palace] Cremation volume of Momchao Kosit (Bangkok, 1925), pp. 82–83. The historical significance of the Front Palace and the political processes accompanying its abolition in the course of modernization are treated in important studies by Charnvit. Charnvit Kasetsiri, "Wang Na: tamnaeng phu sup ratchasombat?" [The Front Palace: The office of the Heir Apparent?] in Ransan Thanaphonphan, ed., *Rak muang thai, phak prawattisat lae kanmuang* [Loving Thailand, history and politics] (Bangkok: Rongphim Thai Watthana Phanit, 1975), pp. 1–34; *idem*, "The Front Palace: The Office of the Heir Apparent?" in Carl A. Trocki, ed., *The Emergence of Modern States, Thailand and Japan* (Bangkok: Institute of Asian Studies, Chulalongkorn University, 1976), pp. 85–92.

Whatever the case, this *na luang* was transformed into a major cultivation area of floating rice (*khao muang* or *khao fang khun nam*). At the same time central and provincial administrations were reformed. The records for R.S. 119 (1900/01) show that jurisdiction of these lands had transferred from the Ministry of Agriculture to the Department of Crown Lands (*Phrakhlang Khangthi*), and that the lands were registered as 5,793.50 *rai* of *na luang* in thirteen villages in *monthon* Krung Kao.[84] Thus the area of riceland reclaimed had expanded only from 4,909 *rai* seven years earlier in R.S. 112 to 5,793.50 *rai*, while 20,158 *rai* of *na luang* granted to the Front Palace still remained uncultivated.[85] In addition, although the grantees are not specified, a further 10,000 *rai* of *na luang* had been claimed in two villages of *monthon* Prachinburi, remote from the capital in the east of the delta. Whether or not the *na luang* was being utilized (*tham hai prayot*), the area of royal ricelands was being expanded at this time when the commercialization of land was advancing, and the royalty and nobility seem to have been deeply involved in the speculative land development of the extensive wilderness of the lower reaches of the delta.

South of Ayutthaya in the lower reaches of the delta, both east and west of the new capital, the excavation of trunk canals had been proceeding since the fourth reign. In the fifth reign from the late 1860s, large-scale canal excavation on the east bank was carried out through public works and private contracts, and large tracts of land adjoining the canals were claimed. The 1880s and 1890s in particular witnessed a rush to develop canals and take possession of lands on the east bank. In R.S. 109 (1890/91) Phraya Surenthora Ratchasena donated to the Crown five thousand *rai* of land around Bang Khanak village on the banks of the Bang Pakong river in Chachoensao province, which was placed under the jurisdiction of the Department of Crown Lands.[86] This land had previously been claimed by Chao Phraya Bodinthoradet and left unused for several decades, but by the time it was donated as *na luang* part was being farmed by numerous peasants who paid land taxes and in many cases held temporary occupancy deeds. The remainder was received as *na luang* and leased to tenant farmers.

In the same Chachoensao province, work was begun in C.S. 1249

84. "Ruang na luang nai monthon tangtang" [Concerning the royal riceland in various *monthon*], *KS*: 3.3/26.
85. Concerning these uncultivated lands Kitahara states that they had already been granted, but this is clearly a misreading. Whether or not it was cultivated, *na luang* was expanding at this time. Kitahara, "Landownership in Thailand," p. 279.
86. "Ruang kho anuyat chapchong thina," [Concerning permission for riceland reclamation], *KS*: 4.4/2.

(1887/88) by Chao Phraya Surawong Waiyawat, the Minister of Military Affairs, on the Preng canal to link the existing Prawet Burirom and Nakhon Nuangkhet trunk canals.[87] Since funds for the project had been granted to this eminent official from the royal treasury, on completion of the work a total of 19,357.8 *rai* at three locations on the west bank of the canal was taken as *na luang*.[88] Documents of the Ministry of Agriculture of R.S. 113 (1894/95) record that these *na luang* were administered by a low-ranking official, Lhang Phaeng, who had undertaken and supervised the canal excavation, and that the farm rents extracted from the tenant farmers were paid into the royal warehouses. A grant of 1,666 *rai* of this *na luang* had been made to a prince and to an official who had provided funds for the canal construction, and it was planned to grant an additional 6,000 *rai* to another prince. In this way, the king obtained ricelands in return for granting permission to royalty and nobles to carry out canal excavations, or as collateral for investment in these projects.

Some of the *na luang* in the delta originated in the fourth reign. The "second king" of this reign, Phra Pinklao, owned *na luang* around the village of Sala Daeng on the banks of the Saen Saep canal, which continued to be held by his princes.[89] And in 1861 Rama IV took possession of about twenty thousand *rai* of *na luang* along the newly constructed Mahasawat canal, which he granted to his princes and princesses. The extensive *na luang* of the Mahasawat canal, in particular, was left as wilderness for a long time after its granting, and from around R.S. 115 (1896/97) frequent disputes arose between royalty and peasants attempting to occupy the land. Consequently, between 1899 and 1903 survey and land-register maps were prepared and the ownership of the royal princes was affirmed.[90] Despite the tradition that *na luang* be held by one generation or while the holder remained in office, by this time permanent tenure accompanied by right of disposal was in part being granted.

In the vicinity of Bangkok were small, scattered areas of *na luang* with a long history of occupancy and cultivation by peasants and a complex pattern of ownership and leasing by royalty and noble officials.

87. Wongsanupraphat, *History of the Ministry of Agriculture*, pp. 145–146.
88. "Ruang thina Khlong Preng," [Concerning the riceland along the Preng canal], *KS*: 3.3/8.
89. "Ruang rao Monchaojing Sawang Wong nai Phraongchao Phanumat ruang thina Khlong Saen Saep Tambon Sala Daeng" [An account of Momchaojing Sawang Wong of the Phraongchao Phanumat family concerning the riceland along the Saen Saep Canal in Tambon Sala Daeng], *KS*: 3.3/3.
90. "Mahasawat," *KS*: 3.3/31.

Ministry of Agriculture documents record *na luang* in eight villages on the east bank, along the Saen Saep canal, and one village on the west bank. Of this, about seventeen hundred *rai* of *na luang* in Sisamak (Huamak) and Saen Saep villages along the Saen Saep canal belonged originally to the Front Palace. It was cultivated by about two hundred clients of the Front Palace (*phrai luang fai Phraratchawang Bowon*), and the supervisor, Phraya Itsaranuphap, contributed eight to ten *kwien* of paddy to the government warehouses. The clients who cultivated the land were exempted from payment in lieu of corvée (*kha ratchakan*) and, since the land was *na luang*, from land taxes.[91]

In R.S. 111 (1892) the Minister of Agriculture, Chao Phraya Surasakmontri, brought all these *na luang* under the jurisdiction of the Department of Rice Granaries (Krom Chang), in an attempt to tighten the management of these scattered lands. The clients of the Front Palace who had been cultivating the land were transferred to the Department of Royal Commodities (Krom Phrakhlang Sinkha) as *phrai luang suai*, and farming was left to the general peasantry, from whom nine times as much produce, ninety *kwien* of paddy, could be exacted for the royal warehouses.[92] Thus around 1890 it appears that the administration of the *na luang* that allowed the king to support members of the royal family was strengthened and that cultivation of *na luang* by tenants grew on a large scale with the collapse of the corvée system.

These letters of the Minister of Agriculture of R.S. 111, which document the important transition period in the administration of *na luang*, concerned petitions for *na luang* near the capital from such people as the royal astrologer and head of the Department of Astrology, Luang Lokthip, who although of low *yot* and *sakdina* held an important post as an attendant of the king. These petitions were made for the land along the Saen Saep canal, but since the government considered it more profitable to retain these lands and rent them to tenant farmers, it proposed that alternative lands in the vicinity of Bangkok should be granted. The exchange of correspondence concerning these grants revealed the existence of several small areas of *na luang* in the vicinity of Bangkok on the east bank.[93]

From the middle of the nineteenth century, the circumstances of granting, ownership, and leasing of the *na luang* in the environs of Bangkok seem to have been exceedingly complex. While the large-

91. "Luang Lokthip and Khun Thepyakon's Application," *KS*: 3.3/5.
92. "Luang Lokthip and Khun Thepyakon's Application," *KS*: 3.3/5.
93. These are *na luang* no. 9 (Sisamak), no. 10 (Saen Saep) and nos. 11–16 in Fig. 8 and Table 1.

scale canal excavations and acquisition of lands were proceeding in the extensive delta wastelands to the east and west of the capital, the small scattered areas of *na luang* in the countryside around the capital were the subject of numerous disputes between agents of princes,[94] and of petitions and direct appeals from distressed royalty and officials.[95]

In the expansion of *na luang* and its administration can be seen the last stronghold of patrimonial state landownership based on the old social order in which the king was the sole landowner. This old order was disorganized in the course of enforced "modernization" in response to external demands for rice, a process which brought expansion of agricultural land and the recognition of private landownership. The existence of *na luang* up to the present is an expression of the contradiction between the traditional patrimonial state and the "modern" state formed since the nineteenth century.

94. "Thina Tambon Bang Bong khong Somdet Phra Sudarat" [Somdet Phra Sudarat's riceland in Tambon Bang Bong], *KS*: 3.2/32.

95. Typical is the dispute carried on between R.S. 108 and 114 (1889–1895) by Phra Nomchan, and the direct appeal for a grant of *na luang* in the vicinity of Bangkok. "Ruang cha phraratchathan thina kae Phra Nomchan" [Concerning royal grant of riceland to Phra Nomchan], *KS*: 3.1/3; "Ruang khwam Phra nomchan klaothot khaluang Krom Na lae kho phraratchathan thina" [Concerning Phra Nomchan's lawsuit against the Ministry of Agriculture and application for royal grant of riceland], *KS*: 3.3/1; Kitahara, "Landownership in Thailand," pp. 276–277.

RICE-GROWING TECHNOLOGY AND LAND TENURE IN THE CHAO PHRAYA DELTA: A CASE STUDY IN PHAKTHAN, SINGBURI PROVINCE

Shigeharu Tanabe

I. Introduction

Paddy-growing in the Chao Phraya delta, its agronomical and ecological aspects, as well as its cultural, geographic and anthropological aspects, continue to command strong interest among scholars. The results of studies published by a team at Kyoto University during the past ten years in physical geography, agricultural geography and irrigation enginnering, have succeeded in indicating how peasant society and its development depended on the natural environment of the area(*1). Moreover, at the same time, there has been in recent years a rapid expansion of studies in cultural anthropology and geography based upon the results of these physical science researches(*2).

This paper reports on farming technology and land tenure in a paddy-growing village in the upper reaches of the Chao Phraya delta. The data upon which this paper is based were obtained in April-May 1978 through a cooperative survey with Dr. Prasert Yamklinfung of the Department of Sociology and Anthropology, Faculty of Political Science, Chulalongkorn University. The object of survey, an administrative village, Tambon Phakthan, is a typical village located on the east bank of Noi River in the Bangrachan district of Singburi province in the upper reaches of the delta(*3). This village is twenty six kilometers from Singburi on the bank of Chao Phraya, northwest, and approximately sixteen kilometers from the Bangrachan district office. The administrative village is large with a 20,008 rai (3201.28 ha.) area. It consists of seven hamlets (muban), the lowest administrative unit, with 636 households (1978).

Although the hamlets constitute the lowest unit of administration with a head man for each, they are all settlements formed gradually from the pre-modern period, except for hamlet number four. Hamlet No.4 consists of the old Raichek settlement and the Don Yangthon settlement along the newly excavated irrigation canal where reclamations started about 30 years ago. In many cases the settlements stretching along the natural levees of Phakthan swamp are not necessarily of the rectilinear type of settlement because clustered-type settlements are found in large numbers. Hamlet No.4 in the Don Yangthon portion is along the irrigation canal and is a discontinuous linear type of settlement.

The oldest communities in Phakthan village believed to be

dating back to the eighteenth century Ayutthaya period are Hamlets Nos.3 and 5, and a part of No.4. These hamlets are in the central part of Phakthan. At its center is the Wat Huai Charoensuk Temple. There are three other temples in Phakthan but all of these were newly erected with development through reclamation after the first half of this century. To these pioneer hamlets, several new settlements were added in later years to form the present Phakthan village.

In this survey, Hamlet No.5 and Hamlet No.4, representing the old and the new respectively, were chosen and all the household heads in them were interviewed, except in Hamlet No.4 where only the Don Yangthon portion was surveyed. Therefore, Hamlet No.4 solely means Don Yangthon. In farming technique and land tenure patterns, many differences are found between Hamlet No.5 and No.4. In the following sections, the characteristics of the paddy-growing and landholding patterns of Phakthan will be analyzed by comparing the data of those two hamlets.

II. HISTORICAL DEVELOPMENT OF PADDY GROWING AND FARMING TECHNOLOGY

1. Historical Development of Paddy Growing

In the upper reaches of the delta that stretches from Chainat to northern Ayutthaya, including Singburi, paddy cultivation technique up until around mid-nineteenth century was of one fixed pattern. In this area with Chainat at its apex, there are many natural levees along the distributary channels of Chao Phraya, Noi, Suphanburi and others. Nearly without a break, a string of settlements developed along these natural levees. Behind them and in parallel stretches are the back swamps which become flooded for quite long periods in the rainy season. That these stretches have become the traditional paddy-growing region on the old delta requires no explanation.

In the era from the Ayutthaya period (1350-1767) to the beginning of Ratanakosin period (1782-circa 1868) it is believed such a delta with its natural levees became the important living space for the village communities with their back swamps paddy filds. Further deep to the rear was the wilderness in which not only wild beasts ran loose, but also stretched monsoon forests abounding with malaria-carrying mosquitoes (cf. Fig. 1).

Near the surveyed Phakthan village, Noi River flowed downstream about two and a half kilometers to the east and along its banks the older hamlets were established. From here to the west was the old river bed. The crescent-shaped Phakthan swamp (Bŭng Phakthan) is situated in this place(*4), and in its back swamps paddy fields were cleared from old times. Along the Phakthan swamp, the old settlements of Hamlet No.5, a part of Hamlet No.4

expansion of ricelands from the latter half of the nineteenth century up to around 1918 while Fig. 3 shows the distribution fields as found in the topographical map drawn by the Division of Maps, Royal Thai Army, from the survey of 1918. These maps show clearly that until the latter nineteenth century the paddy fields were in the back swamps of the Noi River. The clearing of wastelands to west of the Phakthan swamp did not begin until the early twentith century.

These wastelands were covered by monsoon forests with bamboo groves as secondary vegetation. The monsoon forests and bamboo groves were cleared out in mottled streaks and around them hamlets were formed ,and field huts (rong na) were built. Between the mottled pattern of the fields ox cart tracks (thang kwian) needled through the forests.

The paddy fields developed one after another. Hamlets were correspondingly settled and field huts built; the former were divided into several farming compartments (thung) and given proper names. The oldest farming compartment was Phohom field, located between the Phakthan swamp and the Noi River, and followed by the Phakthan field northwest of Phakthan swamp; then the Sadao field to the southeast, and finally Rãichek field, all of which go back to the first half of the nineteenth century. They were the pioneering communities of Phakthan's early years. These four compartments are all in the back swamps of the west bank of the Noi River (Fig. 4). All the farming compartments which developed after the latter nineteenth century are located in the wastelands with local relief to the west. To the northwest from the Phakthan field is the Khu field, and to the west from the Sadao field are Wa field and Klap field which developed in mottled pattern(*11). In these newly opened farming compartments may be found, along the banks of the Phakthan swamp, the small hamlets newly-branched out from the main settlements. The field huts here are scattered haphazardly. The formation of new settlements and the clearing of wastelands continued until about 1950. To the southwest on a wasteland where irrigation was difficult, the Don Yangthon field recently developed. In the monsoon forests which once covered Don Yangthon tigers used to roam until the 1950's.

The development of irrigation as the core of assuring production in these compartments including Don Yangthon, did not take place until the Greater Chao Phraya Project started in 1952; that is, the Chanasut Project (1952-1963), which included the Don Yangthon field and the Boromathat Project (1952-1964)(*12). With the headwork constructed at Chainat and its network of irrigation canals, the distribution of water assured stability to paddy growing in all the farming compartments of Phakthan. The remaining uncultivated lands were then steadily opened to cultivation.

The Greater Chao Phraya Project split Phakthan's ricelands and village community into two. One of these is the Chanasut area, which has its headwork at the Noi River about five kilometers east from Phakthan. It covers the southern part of Phaktan and

includes the Don Yangthon field south of a trunk canal called the Right No.1 Canal (Khlong 1 Khwa) and its hamlet.

The farming compartments and hamlets north of the trunk canal are in the outskirts of the Boromathat area receiving water from a source thirty kilometers away upstream of the Noi River near Chainat. In the Chanasut area embracing the Don Yangthon field, land consolidation was undertaken in 1972-1974. The distribution of water during the dry season thus became possible (*13). The larger part of Phakthan which is in the outskirts of the Boromathat area north of the Right No. 1 Canal did not have any land consolidation and kept to traditional paddy growing. Consequently main-season cultivation by the broadcasting method is still predominantly practiced in this area. On the other hand, in the Don Yangthon field, dry-season cultivation as well as main-season cultivation by the transplanting method developed remarkably.

2. Development of Farming Technology

In the Chao Phraya Delta the traditional broadcasting method has been commonly used. Even in Phakthan along the Noi River, broadcasting is a popular method. In the majority of the farming compartments within the Boromathat Project area, the broadcasting method is used druing the rainy season. In the dry season, within the last few years, the green gram as a dry field crop was introduced and has become widespread. In the Don Yangton area of Hamlet No.4, as a result of land consolidation a constant and ample supply of irrigation water is available and the transplanting method is widely used in both rainy and dry seasons.

The traditional style of paddy-growing technology at Phakthan, i.e., the broadcasting method, is an extensive farming system greatly relying upon natural conditions. From the stand point of rough farming, it is akin to the slash-and-burn technique wherein little else is done artificially aside from preparing the field by burning the trees after cutting them down(*14). For the broadcasting method, one fundamental condition is that surface water comes from adjacent channels for irrigation purposes. Of course water for the paddy field is dependent upon precipitation but even more important is the lay of the land which determines the distribution of surface water. Therefore, while the Greater Chao Phraya Project involved the construction of a irrigation canal network and the improvement of water supply, there is still a dependency upon detailed topography pertaining to the lay of the land. In general, the farmers depended upon the water condition and the minute undulation of land in their choice of seed varieties as well as planting methods in order to adapt to the deltaic environment.

The broadcasting method at Phakthan may be placed in two categories according to the water condition in the field plots during the beginning of the rainy season. In dried field plots the ungerminated seed broadcasting method (samruai) is employed while in puddled field plots where water is able to come in, the

germinated seed sowing method (namtom) is seen(*15). For the samruai method the first rains are awaited; plowing is done by tractors or tillers. In this method the field soil is moisturized. The broadcasting of seeds is accomplished in mid-May. Soon after, usually in two or three days, a tractor or tiller is used for the second plowing (thai prae or thai klop) in order to cover the seeds with soil. Water buffaloes previously provided the motive power but since 1960 farm machines have increasingly been in use while plowing with water buffaloes have almost disappeared(*16). In the samruai farming area, except for the spraying of weedicide in August, the fields are left alone.

Although namtom farms are those for broadcasting method, they look like paddy fields farmed by the transplanting method. In many cases, because namtom field plots are in low-lying swampy land, the plots are in a flooded condition during plowing from April to May. The swampy condition of these lowlands varies from year to year because of the local rainfall pattern. In Phakthan, especially in the Klap and Wa fields, this method still exists in spots.

In the namtom method, at first because of flooding, large tractors cannot be used, where water buffaloes were used in the past, medium size tractors or tillers are now used. From plowing through harrowing into leveling, the land preparation of the namtom method is the same as that for the samruai transplanting method. After this, water is drained from the fields, and germinated seeds are sown. In the samruai method, seeds are sown in all directions while moving forward, but in the namtom method the germinated seeds are sown while carefully moving backwards. Again, as in the case of transplanted fields, the water level in the namtom fields should be carefuly controlled. When the level rose in the past because of rain, the farmers used scooping baskets (chang rong). Today water pumps are employed instead. After the plants take root, water is supplied to the fields.

The paddy fields for the namtom method are only about five percent of the total area of broadcasting fields at Phakthan. In the lowland Klap and Wa fields precipitation from April to May influences the increase and decrease of namtom fields. Be that as it may, the namtom method is adapted only in the partial low-lying land of the delta and is accompanied by land preparation methods quite like those for a transplanted area.

These two are the typical broadcasting methods at Phakthan but there is another method called piakniao which is a hybrid of the two. In a large plot where there are high and dry portions existing together with a swampy portion, plowing but not harrowing is possible. So after plowing is done as in the case with samruai method, ungerminated seed is sown. Either the namtom or the piakniao method is used widely in the delta, especially in the low-lying swampy lands where flooding occurs with the precipitation from April to May.

In contrast to the traditional methods, the transplanting method of Phakthan is used far and wide in recent years. Historically,

paddy growing by broadcasting has predominated since the fourteenth or fifteenth century. However the transplanting method existed too in well irrigated areas(*17). Even today in Hamlet No.5 the Phohom field of the Boromathat Project area, transplanting is done to some extent. This is limited to areas comparatively near the hamlet. It is in Hamlet No.4's Don Yangthon field of the Chanasut area of the already completed land consolidation project that transplanting is most widespread.

Land preparation for transplanting starts with plowing and harrowing, and is completed with leveling. Nursery beds are done in the same way. Large tractors are seldom seen and medium-sized tractors and tillers are used throughout. It goes without saying that water buffaloes were used for plowing and harrowing in years long gone.

The paddy-farming techniques of Phakthan as seen above may thus be divided into two major methods; namely the traditional samruai method used principally in the Phakthan fields, and the transplanting method which has only recently made rapid gains in usage despite its long history. The techniques differ clearly according to how the land is prepared, although they are also influenced by other considerations.

The seeds for the samruai method are of the late varieties with plant heights of 1.5 m to 2.0 m. In the Phakthan swamp area there are many deep-flooding fields: the maximum water depth at Phohom is about 1.5 m; Sadao, 1.0 m; Raichek 1.0 m; Klap, 1.5 m; Wa, 2.0 m; and Khu and Phakthan 0.7 m (cf. Fig. 4). Of course not all fields are this deep, but these figures show the depth of the water in depressions. On the whole, though, it may be said that there are many deep water areas. In these deep waters, of the late varieties the so-called floating rice (khao khun nam) is grown. Others are the medium-term and early varieties, but the late varieties including the floating rice are overwhelmingly used. The yield per rai is 50 to 60 thang.

In the Don Yangthon transplanting area, non-glutinous varieties RD 5 or RD 7, developed as non-photosensitive variety by the Rice Department of the Thai government, are used extensively in the dry season. The RD varieties differ from the traditional ones in that the plant heights are lower, being but 70 cm to 90 cm, and are called 'low rice' (khao tia). These varieties require improved water control, chemical fertilizers, weedicide and insecticides. But the new varieties are used just in the Don Yangthon area and its vicinity where field consolidation has been done. The yield is from 60 to 80 thang per rai.

In all areas of Phakthan where traditional variety is grown by the samruai method, hardly any chemical fertilizers are used, but in the transplanting fields ammonium phosphate (18-24-0, 16-20-0) is used in small quantities after the seedlings take root. Only a small amount of fertilizer, 10 to 12 kg per rai, is used. In recent years, weedicide and insecticides are increasingly used in the transplanting fields.

What then is the farm labor called for in the several phases of farming operation? Fig. 5 is the crop calendar and shows the typical farming operation in Hamlet No.4 and No.5 and the plan of water supply to the Don Yangthon field of Hamlet No.4. In the preparation of land in Hamlet No.4 and No.5, water buffaloes are seldom used now. Reliance is placed on large tractors, medium-sized tractors (rot khlup) and hand-tillers. Tables 1 and 2 show the farm machines and draft animals possessed by the farmers. Water buffaloes are no longer employed and are kept only because the farmers dislike the slaughtering of these animals.

In Hamlet No.4, about half of the farmers possess tractors or tillers and the others hire large tractors. Among relatives, though, it is common to lend and borrow the farm machines freely without cost. Rental fees for tractors average 30 baht per rai and they rent from, and have the work done by, the owners in Phakthan or villages nearby. In Hamlet No.5 very few possess farm machines; the farmers here depend upon hired tractors.

In Phakthan until 1968, nearly all land preparation depended on water buffaloes. It was customary for farmers with these animals to exchange labor. Later with the increase of tractor-work hiring, exchange labor correspondingly decreased and today it has completely disappeared. In 1974, soon after land preparations were completed, a comparatively economical medium-sized tractor (40,000 to 50,000 baht) was put on the market in Hamlet No.4. A certain number of households in this hamlet engaged in double cropping purchased one as did some of the others.

Farmers using the broadcasting method depend primarily upon their family labor. Transplanting method farmers likewise depend upon their family labor for the preparation of nursery beds but for the uprooting and for transplanting tasks, hired labor is used in many cases. Hired hands are not paid on a daily basis but are contracted to render labor on piece-work bases called 'chang mao'. Uprooting pays at the rate of 25 baht per 100 bundles; it is possible to do 200 bundles per day. Transplanting pays 20 to 25 baht per ngan (0.25 rai) and 2 ngans can be done in a day.

Until harvest, weedicide is applied in broadcasting fields, while in transplanting fields chemical fertilizers and weedicides are sprayed. Labor is all done by the family members. In compartments outside of Don Yangthon, the deep-water broadcasting method has gained in popularity. When harvest time comes in December and January, most of the stalks shall have been lodging. While at the deep-water Wa and Klap fields, even at harvesting, the water level is 50 cm, and the Phohom field of Hamlet No.5 have about 30 cm of water. The lodging stalks are cut off at a place about 50 cm to 60 cm from the ear in a scooping motion with a deep curved sickle peculiar to the delta area. The harvested stalks of paddy are usually left on the ground to dry out in the sun for 3 days. Where the ground is still wet, the stalks, to keep them from wetting, are carefully laid on the lodging stubs to dry. Where land consolidation has been done at Don Yangthon,

when the paddy has been fully ripened the water is completely drained so there is no fear of wetting. RD varieties have short stalks and 15 cm to 25 cm are left on the ground and 50 cm to 60 cm stalks are harvested. Like in the broadcasting fields, the stalks are left on the stubs to dry in the fields.

Until 1968, most of the harvesting was done by family labor with the help of exchange labor (kan kho raeng). There were seen some hiring of hands for harvesting even then, but today hired labor has taken over entirely. In Hamlet No.4, cases where even the family does not lend a hand are seen and contracted hired labor has taken an important position. The wages for hired labor during the rainy season is about 25 to 30 baht per ngan, while in the dry season the average is about 15 to 20 baht. The labor is cheaper in the dry season because in comparison with lodging paddy in broadcasting fields, the harvest work is easier and also because during this season, labor is easier to obtain whether from within or without the village.

Harvested and dried in the sun, paddy stalks are bundled with thinly split bamboo or dried leaves of kha (Imperata arundindcea). Even this bundling work (hop khao) is done by hired labor today at the rate of 50 to 65 baht per 100 bundles. The bundled sheaves are set astride carrying poles and brought out from the fields to the roadside, again by hired hands, and then taken by tractor or other farm machines to a threshing floor (lan nuat).

The sheaves are loosened and spread around in a large circle. This work is called 'tok khao'. A rented tractor, large or small, is run over the stalks to trample out the grain. Before the advent of tractors, it was usual to set a pole in the center to which several water buffaloes were tied and the trampling of these animals over the sheaves caused threshing. Whether large or small the rental fee of a tractor is 30 baht per 100 bundles. While the tractor ran over them, the stalks are raised and turned over (ru fang) to complete the threshing. After this, a winnowing machine (khrŭang si bok), run either by hand or power, is used to separate the chaff from the paddy. After the chaff and other undesirables are removed the work is finally done and the paddy is put on the market.

Thus in Phakthan during the past ten years much of the labor has become mechanized with tractors and tillers. Moreover hired labor has been used increasingly. Especially since 1973-1974, with the land consolidation in the Don Yangthon area, the use of farm machines and hired labor have increased greatly for double cropping at Hamlet No.4. At the same time this change has caused Hamlet No.5, still using the traditional broadcasting method and the whole of Phakthan area, to depend more and more on the use of hired labor.

III. Landholding and Developmental Career of Households

1. Modes of Landholding

The opportunities for clearance of the wastelands and claiming (chap chong) existed in the western and southwestern Don Yangthon area even at the early period of the Greater Chao Phraya Project. It is said that only in the time from 1965 to 1968 was the entire frontier of the Phakthan area reclaimed completely. The process of reclamation in the wastelands came rather late when compared with the lower reaches of the river where the reclamation boom occurred in the latter years of the nineteenth and the early twentieth centuries. The back swamp lands of the old delta at the upper reaches of Chao Phraya have been cultivated since the Ayutthaya period and even when the new delta on the lower reaches had been developed there still were many wastelands scattered in the monsoon forests.

Phakthan, being situated west of Chao Phraya River and the Noi River, saw haphazard reclamation until recently because of the distance from the lower delta and its rapid reclamation rush. As has already been mentioned, paddy cultivation in Phakthan has two methods; one being the traditional broadcasting method which is centered around Hamlet No.5 and the other is double cropping, which became possible with land consolidation in Hamlet No.4 of Don Yangthon. Therefore, in our study of landholdings and the problems involved therein, Hamlet No.5 and Hamlet No.4 will be discussed on a comparative basis.

Tables 3 and 4 show the distribution of households, of farm workers by occupation, and the mode of landholding in the two hamlets. In Hamlet No.5, the center of Phakthan village since Ayutthaya period, the percentage of farm households is lower than that of Hamlet No.4 where the basic improvement of paddy fields for farming was completed in recent years. Those engaged in farm work are lower in percentage. But in either case there is no mistaking the fact that in both hamlets paddy cultivation is the main occupation.

The farming households are classified here by the modes of paddy landholding only. Owner farmers hold their field plots, cultivate most of their holdings, and rent out some to others. In the two hamlets in Phakthan there are no landlords who rent out large plots to others. Owner-tenant farmers are those who have land to produce enough paddy for household consumption but rent land from others in addition. Tenant farmers are those without possession of any plot and rent all the plots they cultivate. Apart from a possibility of inheritance or grant in the future, a rent-free cultivation of plots is widely observed between relatives as a favor to each other. This type of 'renting' has been left unclassified but the area so cultivated has been included in the rented paddy area. Farm laborers are those who do not own any paddy fields, do not rent any, and who work

mainly as hired loborers for a living in farms and in other wage jobs in and near Phakthan.

Table 5 shows the distribution of household occupations. In Hamlet No.4, where land consolidation has been completed, full-time farmers are more than half, while in Hamlet No.5, where traditional paddy cultivation is carried on, they are only fourteen percent. In either case there is a great dependency on supplementary occupations. Including contract farm labor, those working as piece-work laborers in the farms of others are in an overwhelming majority. Those working in other miscellaneous jobs are few. In Hamlet No.5, only four farm laborers are landless. It is apparent that actually there are quite a number of owner farmers who work out as farm laborers. In the traditional main-season broadcasting areas of Phakthan, including Hamlet No.5, this trend is especially strong, and they work as farm laborers in Hamlet No.4 or in neighboring villages where double cropping has become possible as a result of land consolidation, and where the demand for labor in uprooting, transplanting, harvesting and others is big.

Tables 6 and 7 show the area of land owned and operated by modes of landholding in Hamlet No.5 and No.4. In both hamlets owner farmers are in the majority. The paddy fields rented in No.5 are more than in No.4. The areas rented include those located outside the village as well as those rented free from relatives. Therefore, even among owner farmers there may be seen a few free renters. Among quite a few owner farmers who rent out land there are many renting out land to relatives rent-free.

What should be noted here is the size of farms operated. In comparison to Hamlet No.5 where only main season farming is done, the off-season cultivation area in Hamlet No.4 is approximately the same size as that operated during the main season. This is apparent when a comparison of the average size of land operated per household in the main season and in the off season is observed. In dry field cropping, more than ninety percent makes use of the recently developed green gram, but because of inexperience the harvest is unstable. In this sense, it does not mean too much in farm operation.

The frequency distribution of land owned and operated by modes of landholding is shown in Tables 8 and 9. In Hamlet No. 5 the land owned by owner-farmers, in comparison to those in Hamlet No.4 are of varying sizes ranging from 62 rai to 4 rai. The fields owned by owner-tenant farmers in both hamlets are less than 30 rai. The size operated by farmers in any category in Hamlet No.4, are is of course larger. The lands operated by owner-farmers are mainly from 10 to 40 rai. On the other hand, in Hamlet No.5 the scale of land operated by owner-farmers shows a large variance.

The percentages of owner farmers and land owned are both higher in Hamlet No.4 than in Hamlet No.5. The average age of the landholders in Hamlet No.5 is more than 40, while in Hamlet

No.4 the owner farmers are on the average 42 years old, followed by owner tenant farmers and tenant farmers in their mid-thirties (cf. Tables 6 and 7). This is first related to the fact that the Don Yangthon field in Hamlet No.4 has had a history of about only 30 years since a pioneering settlement was formed. In addition to this when land consolidation was carried out from 1972 to 1974 there was an increasing number of young owner farmers who, having inherited the plots from the older generation, became independent from their parents.

The legal land ownership in Phakthan is divided into two categories: those who possess full legal ownership rights (kammasit) or hold occupancy rights (sitthi khrop khrong), and those who operate farms despite the fact that they do not possess any legal ownership rights, hoping that such rights may be gained in the future. The former are those who operate farms and have the 'title deed' (chanot thidin), the 'deed of usufructory right' (nangsu raprong kanthamprayot: No. So. 3) or the 'temporary occupancy permit' (So. Kho. 1) under the land laws in the State(*18). The plots so possessed by right recognized under either of the above are included in the area mentioned as land owned. But in Hamlet No.4 and No.5 of Phakthan there are only a few plots so recognized under the title deed and in most of the cases they have recognition by usufructory rights granted by the Land Department of the District Office based on site inspections and rough surveys. But the possessors of the land under No. So. 3 have the usufructory right and right of disposal assured.

Aside from No. So. 3, there are many who hold rights under So. Kho. 1 in which permission is granted by the District Office when requested by those who begin farming. This So. Kho. 1 is a step before gaining the rights under No. So. 3. There are many who hold permits under So. Kho. 1 in Hamlets No.4 and No.5 unable to legally inherit the plots during the lifetime of their parents or at the time of their death, and are thus awaiting their legal possession to be recognized. It is common to claim the plot by appealing under So. Kho. 1 and after several years of cultivation, usufructory and disposal rights can be gained under No. So. 3.

Setting aside the landholdings based on legal rights for the nonce, many instances may be observed in studying the mode of landholdings of farm households in Phakthan where cultivation is carried on with hopes that in the future the land would be inherited from the parents. Legal ownership rests at all times in the parents. Deeds to these rights are in the possession of the parents and when the son or daughter marries and sets up an independent household the plots will be cultivated rent-free by him or her. In such cases no rent will be asked and moreover these plots will be entirely operated independently. Therefore the sale of the harvest is done, and all expenses are incurred, independently. On the other hand, in the process of cultivation the use of the parent's tractor will be rent-free while the family of the son will willingly assist his parents in the labor-demanding periods of uprooting, transplanting and harvesting.

Although parents and children are independent in the production process and its expenses, the reciprocal relationship in labor and in the use of plots rent-free may be observed clearly.

This type of free-renting of land should be distinguished from renting with rental payment and even free-renting from parents in which the future inheritance of the land by their child is not presupposed. Therefore, the size of the area under the former type of free-renting is included in the total area of land occupied, because in Phakthan the plots cultivated by a child with parental consent are customarily considered occupied (khrop khrong) by the son or daughter. There is definitely a gap between this type of occupancy (kan khrop khrong) by the farmers and the occupancy right (sitthi khrop khrong) under the modern land laws. However, the rent-free plots among the farmers, wherein each succeeding year the plots are cultivated by the son, are as a whole, customarily considered occupied by him(*19).

The present predominance of the owner farmers in Phakthan may lie historically in the fact that in the modern period up to the recent years there were unclaimed wastelands spreading to the west from the old pioneering settlements. At the same time, with the passing of the years, the distribution of accumulated land to the succeeding heir, and for that matter, the free renting of the plots by the household head to those who would be heirs in the future, made for the orderly development. That the historically old pioneering settlements, such as Hamlet No.5, still have large numbers of owner farmers and a large area of land cultivated by owner farmers may be due to the possibilities which existed for claiming wastelands closeby. Also new pioneering settlements were formed near newly-cleared lands by those who left the old settlements. Hamlet No.4 is such a newly-branched pioneer settlement and is composed of those from old settlements like Hamlet No.5. The present predominance of owner farmers is attributed to the fact that the Phakthan area is a comparatively late clearing in the upper reaches of the delta, aside from its slow development and the formation of new pioneer settlements(*20).

On the other hand, with the end of the process of claiming arable land around the mid-1960's, there has been an increase in rented plots. Aside from Hamlet No.4 in the Don Yangthon area where land consolidation has been completed, there has been quite an increase of rented land together with an increase in the number of farm laborers since a decade ago. In Phakthan there are no large landlords who have accumulated and rent out land on a big scale. Neither are there many who rent land from absentee landlords. In Hamlet No.4 and No.5 there are only four such cases (*21).

As seen already, rent-free land renting among relatives with reciprocal exchange of labor (included under land renting in Tables 6 and 7), and land renting among relatives, especially between parents and son or daughter with consideration of inheritance in the future (included under landholding in Tables 6 and 7), is commonly practiced. In these renting relationships a strong sense of affection is found among relatives.

What then is the general pattern of landlord-tenant relationship? The rents of the thirty nine farm households in Hamlet No. 4 and No.5 are shown in Table 10. All these land rentings, aside from those involving relatives and non-relatives,are from government lands of the Royal Irrigation Department in the Chanasut Project or of the Religious Department, and in these the rents are quite low. As seen in all regions of the delta, payments of rent are generally of two types: payment in cash or payment in kind. Cash rent cases are far more evident than rent in kind. Up till about 1950 nearly all rents were paid in kind and rents were one kwian (100 thang) of paddy per fifteen rai, or 6.67 thang per rai. From the late 1950s till about the mid-1960s, with land improvement under the Greater Chao Phraya Project and the spread of a commercial economy, rents were set at ten thang or more per rai and cash rents increased rapidly. From about this time cash rents were 100 baht or more per rai while after 1970 the rents increased to the level of 150 to 200 baht. At the same time, payment in kind lessened with a corresponding increase of the cash payment type so that today there are but a few who pay in kind(*22)

A great difference is seen in the pattern of rent payment between those of relatives and those of non-relatives. In most cases between relatives, collection of rents is done after the harvested paddy is sold and cash is on hand, while to others rent is collected even before cultivation begins. This fact is also-reflected in the amount of rent for in most cases rent-rate collected relatives is less than 200 baht while from others it is more than 200 baht. Similarly, tractors are loaned free of charge to kin tenants to their great advantage.

In nearly all cases of tenancy contract, this is done on a yearly basis and by oral agreement; the written contract is rarely signed. When off-season planting is done, a mutual word of oral contract is made even before the main season cultivation is underway. When such contracts are made there does not seem to be any great difference between those of relatives and those of non-relatives. Thus in Phakthan, landholding is dominated by a large group of ownerfarmers. Moreover, rent-free landlord-tenant relations between relatives are common.

2. Developmental Career of Households

Although the pattern of landholding in Thailand is quite varied, it is closely tied with the developmental career of the farm household, in most cases the paddy-growing unit. There are several stages in the formation of a family as a household. A close relationship is found between the developmental career of a family and the acquisition as well as distribution of the land (*23). Therefore, in order to clarify deeply the character of landholdings in Phakthan, it is necessary to analyze the pattern of landholdings and, at the same time, their relationship with the developmental stages of a family.

The family types in Hamlet No.5 and No.4 of Phakthan are shown in Fig. 6. The capital letter S signifies a single family, while the letters NF refer to a nuclear family. Though NF(y) is made up of a husband and wife and unmarried children, it is a nuclear family with those who have not left the home to marry. The legend NF(o) shows which progenies have left the home for marriage and yet is a nuclear family. Aside from nuclear families, stem families are often seen. Letter S shows a stem family of three generations or more. The symbol SA on the other hand is a stem family with parents, unmarried children and one married couple with children. Other symbols used are (m) which stands for a family of uxorilocal marriage; (p) which shows the form of residence after marriage is virilocal; SB is a family with parents and one married progeny couple with children and usually means that the brother and sister of the married couple have left home, while (m) and (p), as in the case of SA, show the form of residence after marriage. SC is a stem family of SA or SB in which the brother or sister of the parents are living together with the household. In SD the married children of the progeny couple of SB live together, and may include their children making a stem family of four generations.

The distribution of family types according to modes of landholding in Hamlet No.5 and No.4 is shown in Tables 11 and 12. In both hamlets nuclear families belong to the majority. The characteristic here is found in the great number of young NF(y) from which the young couple have not left the home. It should be noted that there are more than eighty five percent of nuclear families in Hamlet No.4. On the other hand, there are but a few stem families of more than three generations in Hamlet No.4. Hamlet No.5 has thirty six percent or more, and many varied patterns of stem families. What is common to both hamlets in the mode of stem families is that in many cases the form of residence of the progeny couple is uxorilocal(*24). This point reflects the customary tendency of inheritance that, although an equal distribution of land to the children would be ideal, the larger inheritance of paddy field will be apportioned to the youngest daughter who takes a good worker groom (luk khoei) to look after the parents and work the paddies. The parents giving greater consideration to the youngest daughter instead of the older progenies shows the dependency they place in her luk khoei for their old age welfare. Instead of the lineal descent relationship pattern of Japn, that of Phakthan leans toward matrilineality (*25).

The young farm households are in most cases a nuclear family NF(y), some of which have already inherited their own land but some others cultivate the land of the parents which eventually will be inherited also. There are cases where they posses occupancy as well as legal ownership rights. Again, they hope to inherit land from both the husband's and wife's parents. In such nuclear families as the years pass, with the progeny couple living with the parents, they form the SA pattern, or by leaving the parents they take on the NF(o) pattern. Generally at this stage the household head's parents will have reached old age and ownership

rights by inheritance will have passed to him. Again independent young households making a nuclear family may be given plots as heritage or permitted to cultivate them under customary occupancy.

The parents in the NF(o) and SA families further will see separation and independence of the progeny couple and upon reaching old age live with the youngest daughter couple for old-age welfare. The stem family SB starts from a nuclear family and by the time the children leave it to be independent, it keeps on distributing parcels of land to the children. This is one of the typical points in the developmental career of families. In Phakthan, SC is a very rare example. A four generation SD stem family is also rare. Upon reaching old age and having distibuted all the plots to the progenies, there are those old parents who do not live with the young couple but receive living expenses from them. In Hamlet No.5 there are two old couples who do so. Such couples no longer farm so they are not considered farm households.

In this manner the developmental career of a family in Phakthan is the process of acquisition and distribution of paddy fields. Until the mid-1960s it was possible to get possession rights to unclaimed land. Because of the possibilities for reclamation and the forming of pioneer settlements in the frontier of the Don Yangthon fields, the acquisition and distribution of paddy fields relative to the developmental carrer of families were carried on quite smoothly. However today with possibilities of claiming closed off, the farmers' holdings are getting smaller and the trend toward tenancy is growing.

In looking at the family types in relation to landholding there is a large number of nuclear families in each landholding category in Hamlet No.4 as compared with Hamlet No.5 where owner farmers, owner-tenant farmers, and tenant farmers with three generation stem families are considerably numerous. In the old pioneer Hamlet No.5, the tenant farmers instead of being in nuclear families tend to be of stem families. As tenant farmers they have little hope of owning land in the future. In Hamlet No.5, the household heads who are owner farmers and tenant farmers in the case of stem families, are comparatively old . They do not have land ownership rights under No. So. 3, while the cultivated plots are owned by even older parents in many instances. There are many cases where they have neither succeeded to, nor were given the land they have occupied for a long time.

This situation in Hamlet No.5 is shown on Table 13 with the family pattern as well as the owned and occupied paddy areas. In comparing the two hamlets the area of land simply occupied in Hamlet No.5 is quite larger. In both hamlets the area owned by the NF(o) type of nuclear family with a relatively old household head is large, followed by the NF(y). It is only natural that many plots with recognized ownership are in NF(o). An NF(o) nuclear family with the household head in his forties, and where some progenies have left it to be independent, has succeeded to ownership to the possible extent from their parents. Such a family is most stable in its developmental career. In the younger nuclear

family NF(y), it can be seen that the members already own lands while at the same time possessing a fair amount of occupied lands. Tne younger nuclear family has been allowed to cultivate plots they will eventually inherit from their parents. Most of the plots occupied in this fashion by the young nuclear family NF(y)in Hamlet No.4 compares with many of the stem families having old household heads in Hamlet No.5. The reason most of the occupied lands belong to the young nuclear families in Hamlet No.4 lies in the fact that the clearing and claiming of the lands in the Don Yangthon fields occurred recently. These young nuclear families are only one generation removed. Many of the parents of the pioneer days have kept the right of ownership while letting the progeny couple work the land in a large number of cases. In contrast, many instances in Hamlet No.5 involved succession to and inheritance of plots only after long periods, and in several situations, strictly after the death of the parents. Therefore, the progeny couple who already formed a stem family experienced prolonged occupancy periods for tens of years. In this way differing patterns of acquisition and distribution of land in relation to family types may be observed between the old hamlet dating back to the Ayutthaya period, and the hamlet opened in the postwar era.

IV. Concluding Analysis

It may be said that Phakthan is a typical paddy-growing village of the upper reaches of the Chao Phraya delta by observing the paddy cultivation techniques as well as the historical development of the delta. Phakthan's pre-modern rice growing method in the back swamps of the Noi River where the broadcasting method of sowing rice is done can still be seen widely in the upper delta region. Since the late nineteenth century, in the lower deltaic reaches, a large-scale reclamation of land for producing rice for exportation to other countries took place. However, in the northern portion of the delta, the expansion of ricelands did not develop in such a scale and speed. The west bank of the Noi River including Phakthan, despite the rapid change directly influenced by export-rice production along the main stream of Chao Phraya, remained in the marginal area. Later, the paddy lands in Phakthan gradually spread west and southwest from the back swamps towards the wastelands. However, what greatly influenced the socioeconomic conditions of Phakthan was the improvement of the irrigation network undertaken by the Greater Chao Phraya Project started in 1952. Moreover, the consolidation of the Don Yangthon fields in the Chanasut area of the project, which brought a steady water supply to the plots, made possible double cropping by the farmers in Hamlet No.4. With the development of Greater Chao Phraya Project and its concomitant land consolidation scheme, the use of machinary for land preparation gained impetus since the latter half of the 1960s. At the same time, the use of hired tractors for cultivation and hired laborers for most of the farming process gradually became popular.

The traditional paddy-growing technique in Phaktan generally characterized by the broadcasting method has been developed further in the varied ways of land preparation and sowing according to the topographical and water conditions of the region. At the same time, after the consolidation the Don Yangthon fields allowed the incorporation of double-cropping by the transplanting method. From land preparation to harvesting and processing, a large force of hired laborers came to be used. From the latter half of the 1960s more and more hired labor was employed in farm operations. This is especially true in recent years in Hamlet No.4 particularly following the completion of land consolidation.

In rice-growing, it is impossible to work all the steps in farm operation by family labor alone. When intensive labor is required a system of labor exchange called ao raeng, kho raeng, or long khaek, has been customarily used since the old days. In Phakthan until the mid-1960s labor exchange existed. Plowing and land preparation with water buffaloes, as well as harvesting, bundling, and threshing depended upon reciprocal labor exchange, or long khaek. However, with the development of a network of canals, the increasing use of tractors, the construction of roads, and other improvements, together with the growth of a commercial economy, labor exchange rapidly lost favor. It was replaced by the hired labor system. This trend became strong especially after land consolidation, and as in Hamlet No. 4 where double cropping is done, hired labor came into demand. The farmers of Phakthan outside Hamlet No.4 were given opportunities for earning cash income quickly during the dry season. The demand for piece-work labor is not confined to double cropping alone because in all phases of traditional Phakthan paddy growing, hired labor is speedily acquiring wide usage.

Consequently, the paddy-growing techniques and the pattern of farm labor changed from the latter half of the 1960s. The farm operation by each household also saw great changes. This is clearly seen in Hamlet No.4 where double-cropping is done. Since 1974, although there has been a large increase in farm income, hired labor has come into use in all phases of cultivation. Naturally, wage expenses for labor are large. Therefore, it can be seen that in each farm household, the wage expenses constitute more than half of the total production costs. Fig. 7 shows the agricultural cash income and production costs as well as wage expenses. Table 14 shows the production costs for paddy cultivation according to the mode of landholding. In all cases the income and expenditure of Hamlet No.4 is far more than that of Hamlet No.5 and expenses for wages, chemical fertilizers, weedicide, and the operating costs of the farm machinery show a yearly upward trend. In per unit area costs, those of Hamlet No.4 far surpass those of Hamlet No.5.

Although there has been changes in cultivation techniques, use of labor, and farm operation, there is still a fairly large amount of owned or occupied land. Here again there seems to be a trend toward tenant farming; paddy fields rented are increasing in number. At least until the mid-1960s there were opportunities for clearing wastelands in order to eventually hold them, but

in irrigation should be examined. In Phakthan it seems that the villagers have not been too deeply concerned with the artificial management of irrigation water. This is because the extensive broadcasting method of cultivation can be adapted to the deltaic environment without collective efforts for irrigation. Thus, although relatively small works may have been done when the necessity arose, the villagers in Phakthan have not developed any permanent cooperative organization for irrigation. This is related to the fact that an irrigation water users' group has not been organized among farmers even after the completion of the Chanasut irrigation canal network under the Greater Chao Pharaya Project.

In the course of paddy production the traditional reciprocal laborexchange had been widely practiced until the mid-1960s. The long khaek laborexchange system was usually operated among those who cultivated neighboring plots in each farming compartment. At the same time, these neighboring plots have been largely operated by relatives reciprocally. Therefore, the long khaek was well organized in the fields of old pioneer hamlets including the surveyed Hamlet No.5. In contrast, it was scarecely performed the newly reclaimed Don Yangthon fields of Hamlet No.4. Anyhow, cooperation among farmers is rapidly disappearing in many phases of paddy production. The long khaek laborexchange arrangement, once a typical scene of village life in the Chao Phraya delta, has been mostly replaced by hired labor. A discussion on the merits or demerits of this situation requires another paper.

Notes

*1. See Tadayo Watabe, "The Glutinous Rice Zone in Thailand: Patterns of Change in Cultivated Rice;" Hayao Fukui, "Environmental Determinant affecting the Potential Dissemination of High Yielding Varieties of Rice: A Case Study of the Chao Phraya Basin;" Yoshihiro Kaida, "Agro-Hydrologic Regions of the Chao Phraya Delta;" and Kazutake Kyūma and Keizaburo Kawaguchi, "An Approach to the Capability Classification of Paddy Soils in Relation to the Assessment of their Agricultural Potential," in Shinichi Ichimura (ed.), Southeast Asia: Nature, Society and Development Contributions to Southeast Asian Studies. Honolulu: The University Press of Hawaii, 1976; also Shinichi Ichimura (ed.), Ine to nōmin [Paddy and Peasants]. Kyoto: The Center for Southeast Asian Studies, Kyoto University, 1975.

*2. Takashi Tomosugi, "Concepts of Labor in Peasant Societies in Northern Chao Phraya Delta: An Economic Anthropological Approach to Social Change," in S. Hirashima (ed.), Hired Labor in Rural Asia. Tokyo: Institute of Developing Economies, 1977, pp.154-169; and Shigeharu Tanabe, "Land Reclamation in the Chao Phraya Delta," in Yoneo Ishii (ed.), Thailand: A Rice Growing Society. Honolulu: The University Press of Hawaii, 1978, pp.40-82.

*3. Amphoe Bangrachan, Raingan kansamruat khomu khetphatthana tambon phathan amphoe bangrachan changwat singburi [A Survey Report of Development Area, Phakthan Village, Bangrachan District, Singburi Province] (mimeographed). Amphoe Bangrachan, 1977. This is a handy general report by a district development worker (phatthanakon) commissioned to study the village concerned.

*4. Bŭng is a long channel with stagnant water behind the main river.

*5. In this period the wilderness areas of the delta became the hideout of robbers and bandits (chon phurai), aside from the natural dangers feared by the peasants. Significant examples may be seen in Ayutthaya, Singburi and Suphanburi regions, but little material can be found concerning these bandits in the surveyed area.

*6. Robert Lingat, Kotmai tra sam duang [The Low of the Three Seals], Vol.1. Bangkok: Ong kankha khong krusapha, 1972, p.72.

*7. Ratchabanditsathan, Akkharanukrom phumisat thai chabap ratchabanditsathan [Royal Academy Edition of Dictionary of Geography in Thailand], Vol.3. Bangkok: Ratchabanditsathan, 1964, pp.1451-1452.

*8. Phraratchaphongsawadan chabap phraratchahatthalekha [The Royal ~~orthographic~~ Autographed Version of Royal Chronicle of Ayutthaya Period], Vol.2. Bangkok: Samnakphim klangwitthaya, 1970, pp.277-283: Khana kammakan fŭnfu burana khai bangrachan, Wirachon khai bangrachan [The Heroes of Bangrachan Fort]. Singburi: Khana kammakan fŭnfu burana khai bangrachan, 1976, pp.7-14.

*9. Phrachomklao chaoyuhua (Mongkut), Phrachum prakat ratchakan thi si [Collected Proclamations of the Fourth Reign], Vol.2. Bangkok: Phim chaek nai ngansop phramahaphothiwongsachan inthachotthera, 1968, pp.162-168.

*10. Maruphongsiriphat, phrachao nongyathoe krommamŭn, Kantruat lae chat ratchakan nai monthon krungkao lae monthon prachinburi [The Inspection and Adiministrative Arrangement in Monthon Krungkao and Monthon Prachinburi]. Bangkok: Phim nai ngansop nang hia sirisap, 1972, p.21.

*11. In the Khu field, as signified by the work khu (meaning moat), there are ruins of rectangular mounds and moats dating from the Ayutthaya period.

*12. Changwat Singburi, Raingan sarup khoratchakan khong changwat singburi pho so 2519 [Administrative Report of Singburi Province, B.E. 2519]. Singburi: Salaklang changwat singburi, 1977, pp.11-12.

*13. Changwat Singburi, Ibid., pp.13-14.

*14. Land preparation in wastelands involve the felling and burning of trees as well as bushes during the dry season. After plowing in the partially cleared land with standing trees and stumps, seeds are sown by the broadcasting method when rains come. The first two years following the clearing show a yield of sixty to seventy thang per rai, but after this, the yield falls rapidly.

*15. Two kinds of broadcasting are widely seen in the delta, but the methods are called by differing names according to the region.

*16. Until today there are instances of the use of water buffaloes for ~~second~~ cross plowing.

*17. The transplanting method has been used widely in the intermontane basins of Northern Thailand, since the ancient period, in contrast to the delta where it has been in use only in limited areas. Shigeharu Tanabe, "Lannathai (hokubu tai) no suiri keitai ni kansuru kōsatsu, mŭang-fai o meguru ni san no mondai [Irrigation Systems in Lannathai History: Around the Mŭang-Fai]," in Imanishi Kinji hakase koki kinen ronbunshū, tanken, chiri, minzokushi [Essays in Honour of Dr. Kinji Imanishi of his Seventieth Birthday, Vol.3, Expedition, Geography and Ethnography]. Tokyo: Chūōkōron sha, 1978, p.198.

*18. The outline of present land laws was completed in 1954. Sup Wisetso, Pramuan kotmai thidin [Collected Land Laws]. Bangkok: Krom thidin, 1973, pp.1-55; Somchit Thongpradap, Khamathibai pramuan kotmai thidin [A Commentary of the Collected Land Laws]. Bangkok: Phrae phitthaya, 1974, pp.1-25.

*19. The gap between the modern land laws and the customary laws of land tenure is pointed out in Tōru Yano, "Land Tenure in Thailand," Asian Survey, Vol.8, No.10 (1968), pp.853-863.

*20. In addition to the rapid expansion of paddy lands and villages in the lower delta region since the latter half of the nineteenth century, there is a general pattern of paddy land expansion with the formation of new settlements in the marginal areas. This type of forming branch settlements is studied in detail by Yano, Ibid., pp.855-860.

Absentee landlords living outside villages are generally called nai thun. They usually engage in trading together with moneylending to nearby farmers at high rates of interest in district towns. In the vicinity of Phakthan, the nai thun mostly live in Singburi, Inburi and Chanasut. Up till about the mid-1960s the practices of land mortgaging (khai fak) and paddy selling before ripening (tok khao) prevailed among farmers. As a consequence, the nai thun actively accumulated land on a large scale. Therefore, the predominance of owner farmers in Phakthan is a case involving a remote area from the district town. It should be noticed that from the Noi River, the closer one gets to Chao Phraya River the higher the percentage of rented farms become. There has been a rapid accumulation of land in these areas during the past twenty years.

In 1974 the rents were officially kept down at 100 to 150 baht (under eleven thang in kind) per rai for the ordinary plot while 150 to 200 baht (under twelve thang in kind) for the consolidated plot in the Bangrachan District. This was an attempt to control of land rent under the democratic policy of the Sanya Thammasak cabinet. Today the rent, in general, far exceeds these figures. Pho Saemlamchiak (ed.), Phrarachabanyat khuapkhum kan chao na phutthasakkarat 2517 [The Royal Decree for Control of Tenancy, B.E. 2517]. Bangkok: Samnakphim thammabannakhan, 1974, pp.1-19.

Kōichi Mizuno, "Multihousehold Compounds in Northeast Thailand," Asian Survey, Vol.8, No.10 (1968), pp.848-850; Atsushi Kitahara, "The Forms of Rural Labor and Their Role in the Rural Economy in Thailand," in S. Hirashima (ed.), Hired Labor in Rural Asia, 1977, pp.127-129.

In the rule of residence after marriage among the Thai people there is a great variance. Concerning the traditional pattern of residence Keiji Iwata's detailed study of Thais in northern Indo-China peninsula is superb. See Keiji Iwata, "Indo-shina hantō hokubu ni okeru thai shozoku no kazoku to shinzoku, tai yai, tai nua, tai lu zoku shakai no hikaku [A Comparative Study of the Social Organization of Three Thai Groups: Tai Yai, Tai Nua and Tai Lu]," Minzokugaku kenkyū [The Japanese Journal of Ethonolgy], Vol.29, No.1 (1964), pp.13-18. In Phakthan, as far as Hamlets No.4 and No.5 are concerned, more than seventy percent are uxorilocal in pattern during the first years. After this, although many residential changes may be seen, in many instances the couple return to the woman's natal house in order to support the wife's parents. According to Anuman Rajadhon, by marriage, the manpower has to move to the bride's household in order to overcome the relative labor shortage in relation to paddy area. See Anuman Rajadhon, The Story of Thai Marriage Custom, Thailand Culture Series No.13. Bangkok: Department of Fine Arts, 1956, pp.6-7.

The matrilineal descent group found in Lannathai cannot be

observed in Phakthan. Refer to Andrew Turton, "Matrilineal Descent Groups and Spirit Cults of the Thai-Yuan in Northern Thailand," Journal of the Siam Society, Vol.60, Part 2 (1972), pp.217-256; Shigeharu Tanabe, "Lannathai nōson ni okeru kankyō ninshiki, seikatsu kūkan to shūgōrei girei o megutte [Cognition of Enviro ents in a Lannathai Rice-Growing Community of Northern Thailand: Landscape and Peasants' Beliefs in Guardian Spirits]," in Naomichi Ishige (ed.), Kankyō to bunka, jinruigaku teki kōsatsu [Environment and Culture: Anthropological Studies]. Tokyo: Nihon hōsō kyōkai shuppankai, 1978, pp.104-116.

Fig.1 MAP OF TAMBON PHAKTHAN

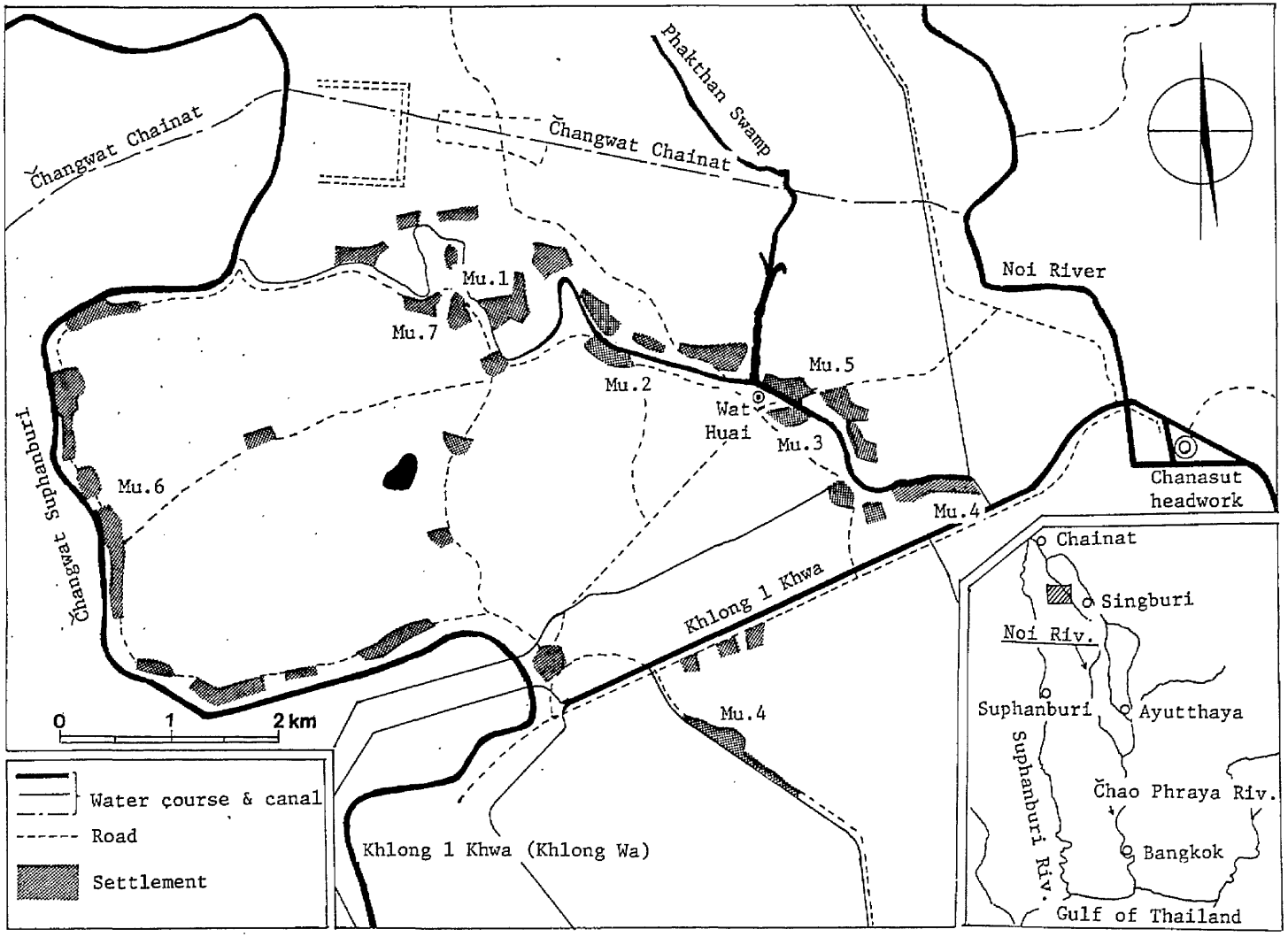
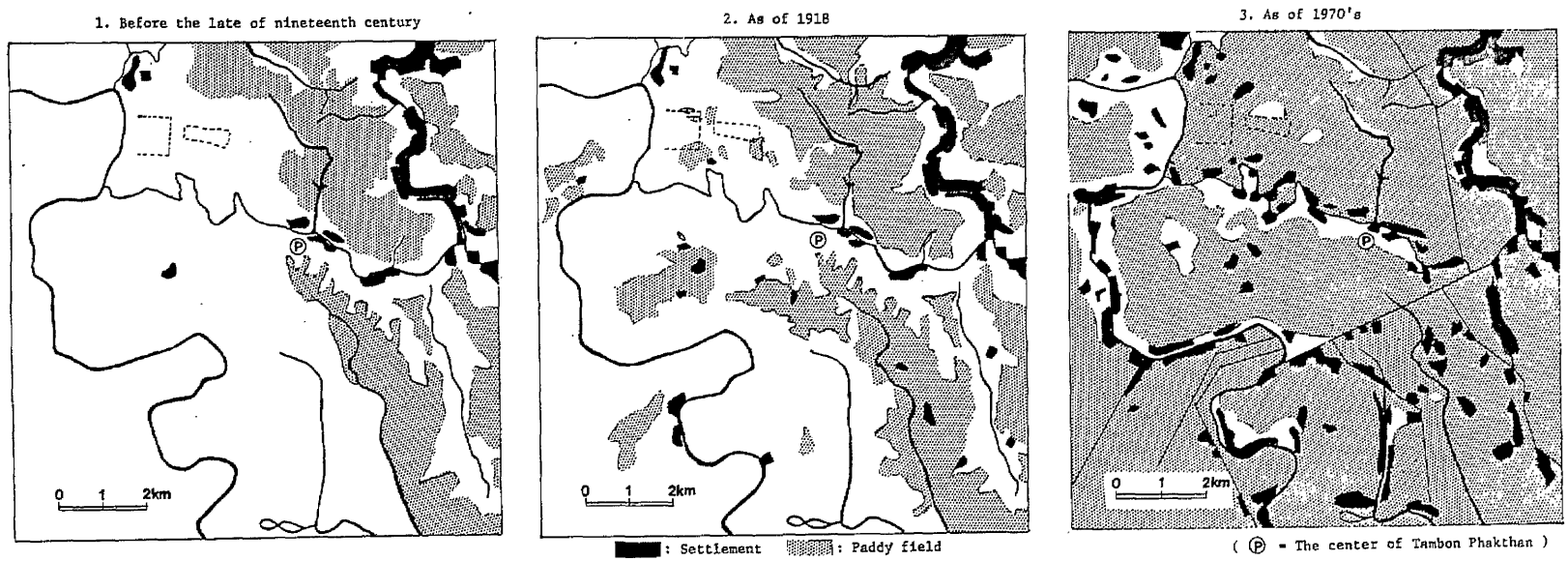


Fig.2 STAGES OF PADDY FIELD RECLAMATION IN THE WEST BANK OF THE NOI RIVER



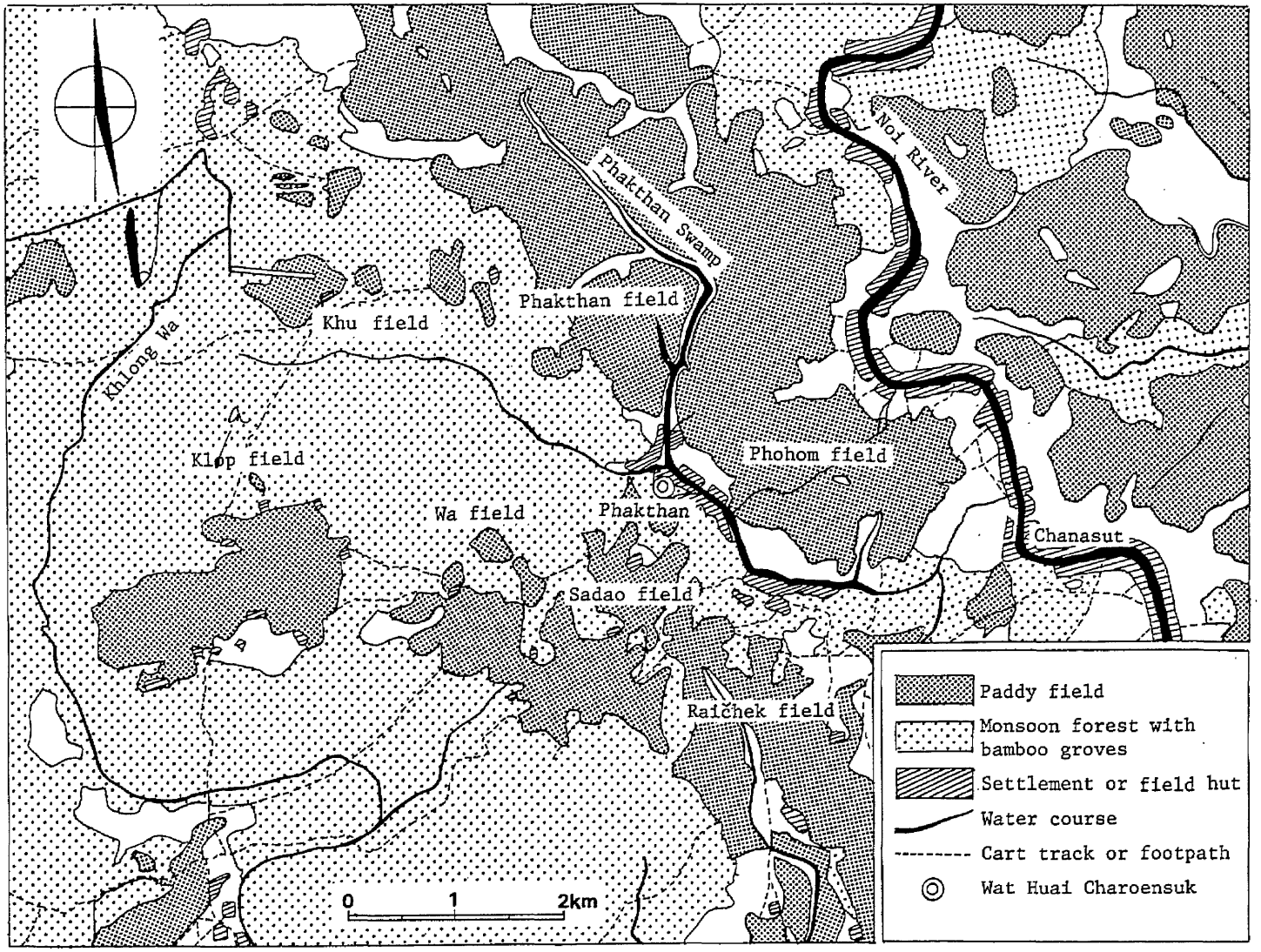

Noi River
Phakthan Swamp
Phakthan field
Khu field
Khlong Wa
Klop field
Wa field
Phakthan
Phohom field
Chanasut
Sadao field
Raichek field
0
1
2km
Paddy field
Monsoon forest with bamboo groves
Settlement or field hut
Water course
Cart track or footpath
Wat Huai Charoensuk

Fig.4 MAP OF THE FARMING COMPARTMENT (THUNG) AND RECLAMATION PROCESS IN PHAKTHAN

(The figure in parenthesis indicates the water depth in the depression of each compartment.)

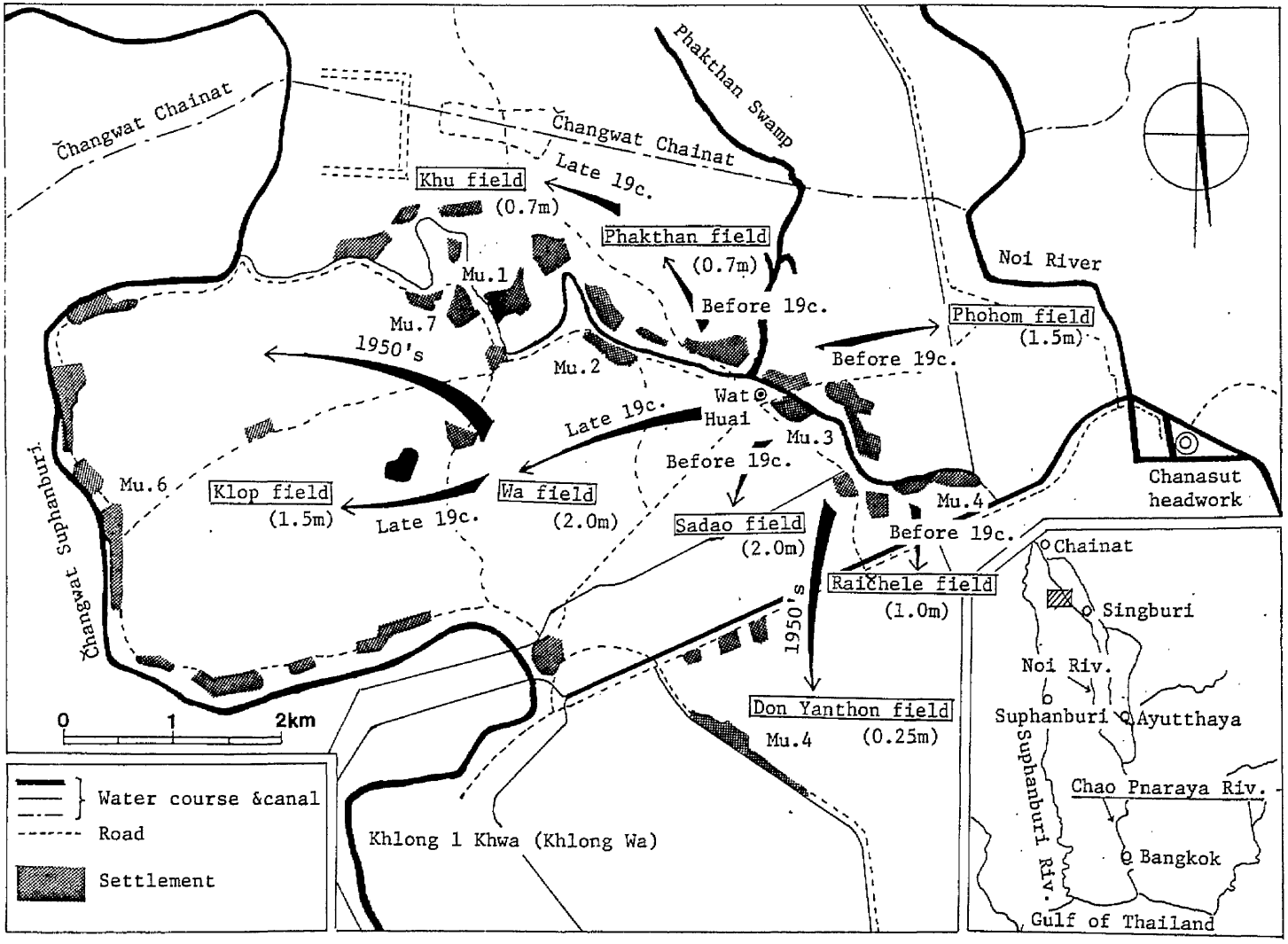
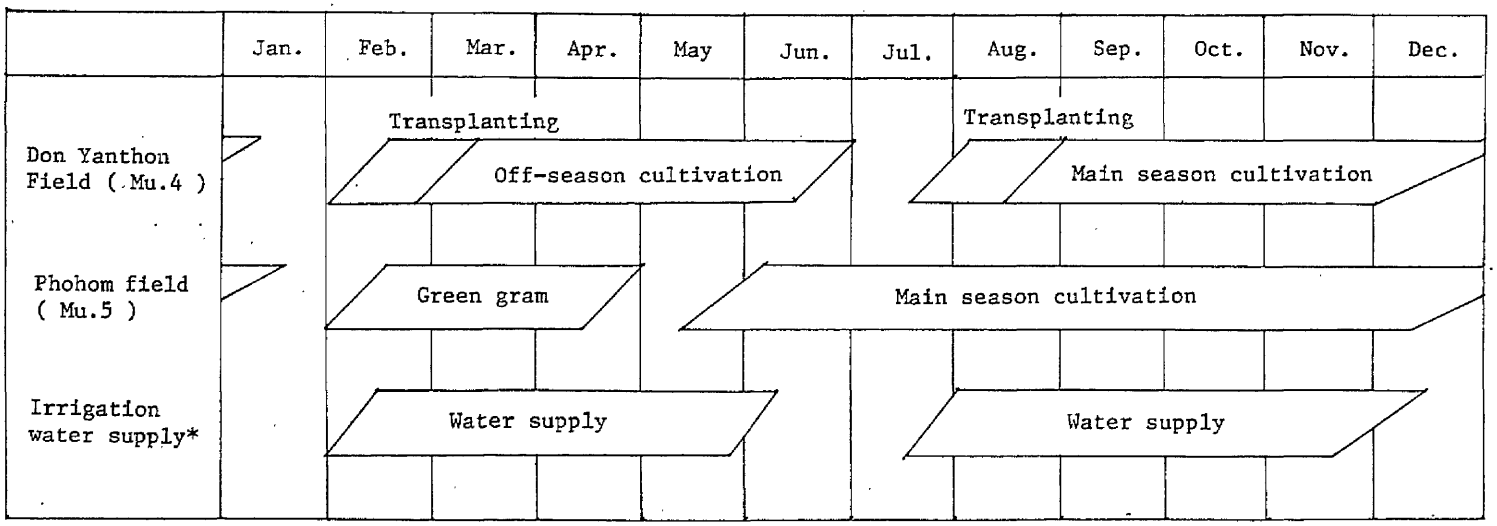
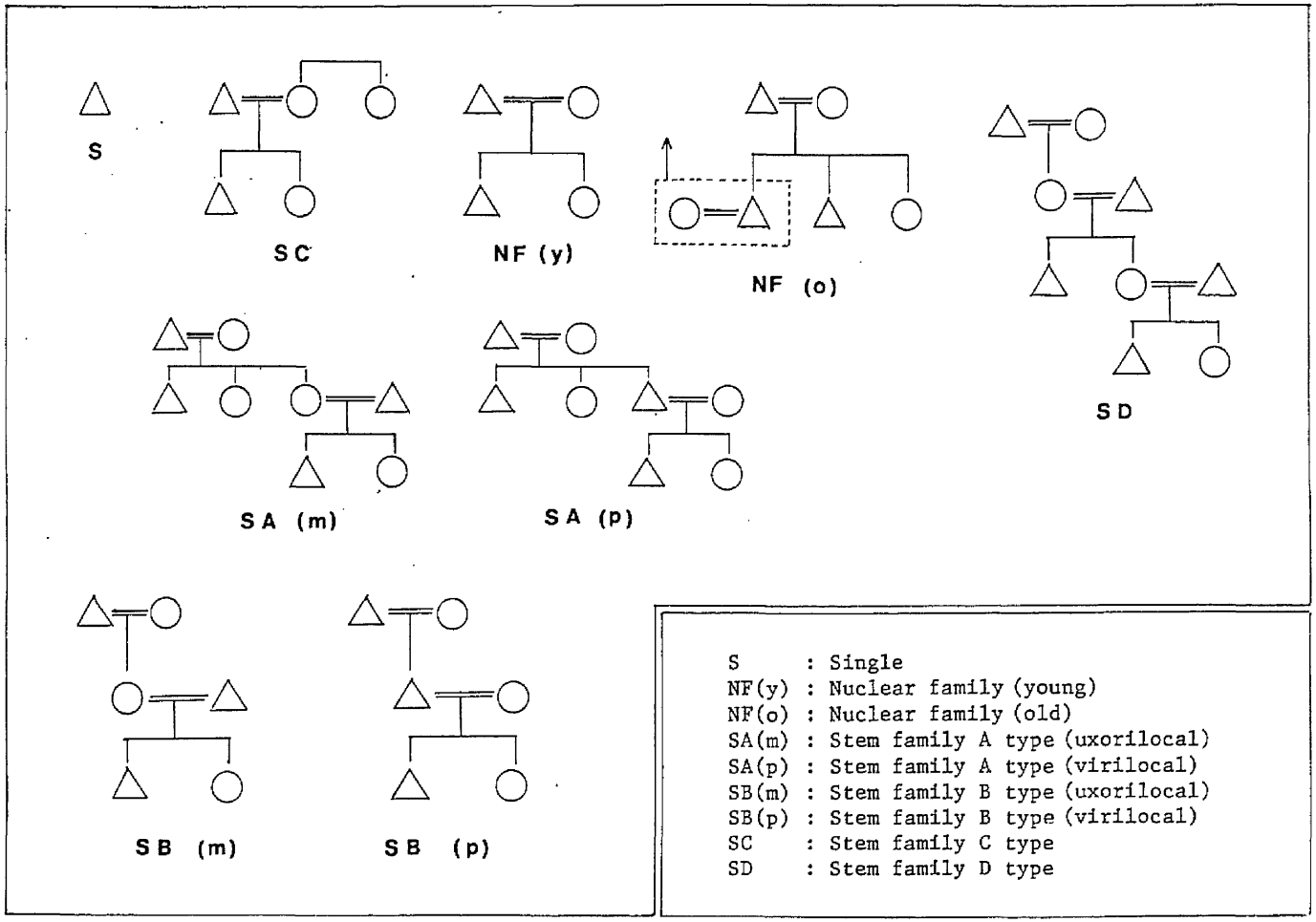


Fig.5 CROP CALENDAR IN PHAKTHAN



(* Indicates the plan of irrigation water supply in the Chanasut project area)

Fig.6 FAMILY TYPES IN PHAKTHAN



S : Single
NF(y) : Nuclear family (young)
NF(o) : Nuclear family (old)
SA(m) : Stem family A type (uxorilocal)
SA(p) : Stem family A type (virilocal)
SB(m) : Stem family B type (uxorilocal)
SB(p) : Stem family B type (virilocal)
SC : Stem family C type
SD : Stem family D type

Fig.7 AGRICULTURAL CASH INCOME AND PRODUCTION COSTS FOR PADDY CULTIVATION

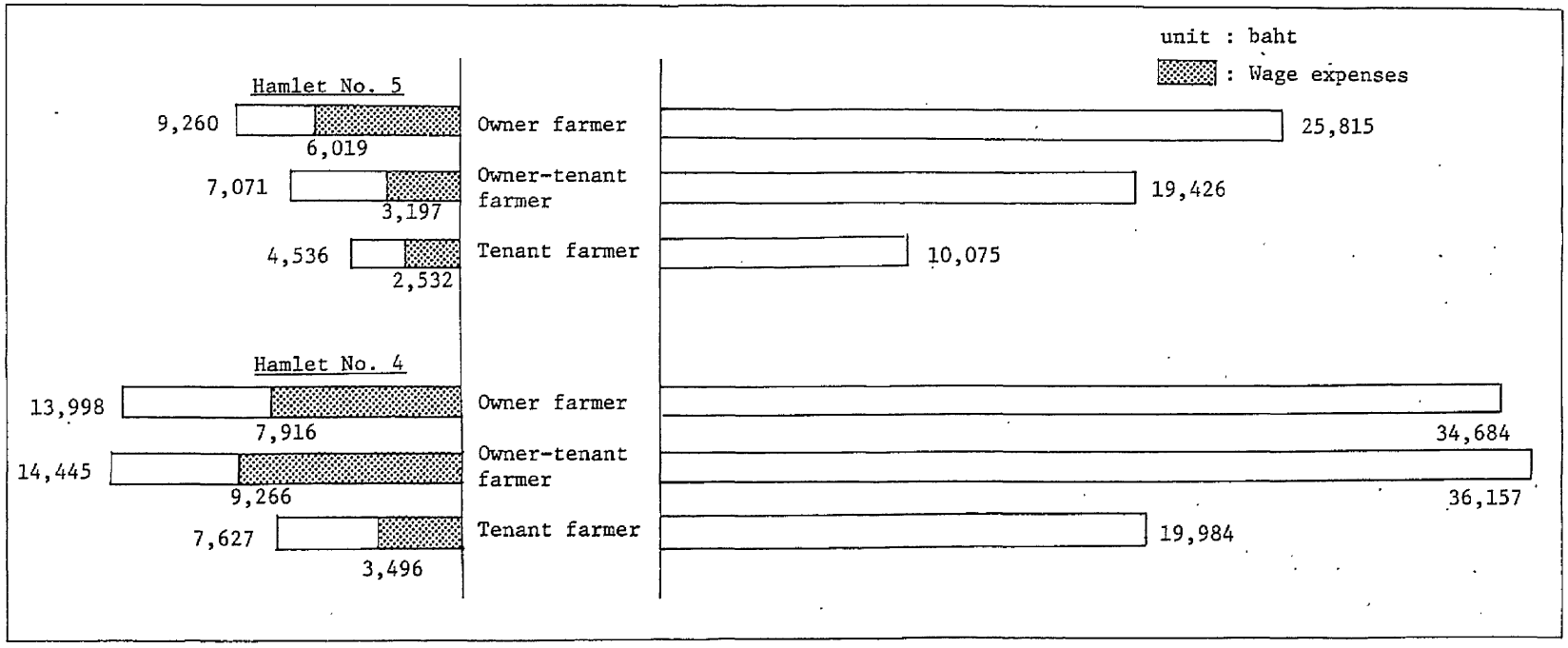


Table 1 OWNERSHIP OF FARM MACHINES AND DRAFT ANIMALS (Hamlet No. 5)

Mode of land tenure	Number of households	Farm Machines					Draft Animals	
		Tractor (large size)	Tractor (Medium size)	Tiller	Water pump	Sprayer	Buffalo	Cow
Owner farmer	22	1	1	2	4	14*	2	2
Owner-tenant farmer	16	-	-	1	4	9	-	-
Tenant farmer	6	-	-	-	-	4	-	-
Total	44	1	1	3	8	27	2	2

(* Including a large sprayer)

Table 2 OWNERSHIP OF FARM MACHINES AND DRAFT ANIMALS (Hamlet No. 4)

Mode of land tenure	Number of households	Farm Machines					Draft Animals	
		Tractor (large size)	Tractor (medium size)	Tiller	Water Pump	Sprayer	Buffalo	Cow
Owner farmer	36	-	12	8	5	27*	-	4
Owner-tenant farmer	7	-	1	3	2	5	-	-
Tenant farmer	5	-	1	-	-	5	-	-
Total	48	-	14	11	7	37	-	4

(* Including two large sprayer)

Table 3 DISTRIBUTION OF HOUSEHOLDS AND FARM WORKERS BY OCCUPATION

(Hamlet No. 5)

Occupation (Mode of land tenure)		Number of households (%)	Number of Household members	Number of those engaged in farming
Agriculture	Owner farmer	22 (39)	115	60
	Owner-tenant farmer	16 (28)	84	50
	Tenant farmer	6 (10)	36	22
	Farm laborer	4 (7)	17	6
	Others (fishing, poultry breeding)	4 (7)	24	13
	Total	52 (91)	276	151 (54.7%)
Unskilled laborers		1 (1)	4	0
Govt. officials or employee		2 (4)	9	1
Others (no income)		2 (4)	4	1
Total		5 (9)	17	2
Sum total		57 (100)	293	153

Table 4 DISTRIBUTION OF HOUSEHOLDS AND FARM WORKERS BY OCCUPATION

(Hamlet No. 4)

Occupation (Mode of land tenure)		Number of households (%)	Number of Household members	Number of those engaged in farming
Agriculture	Owner farmer	36 (74)	173	109
	Owner-tenant farmer	7 (14)	42	21
	Tenant farmer	5 (10)	18	11
	Total	48 (98)	233	141 (60.5%)
Others (car repairman)		1 (2)	5	-
Sum total		49 (100)	238	141

Table 5 DISTRIBUTION OF HOUSEHOLD OCCUPATION BY MODE OF LAND TENURE

		Hamlet No. 5				Hamlet No. 4			
		Owner farmer	Owner-tenant farmer	Tenant farmer	Total	Owner farmer	Owner-tenant farmer	Tenant farmer	Total
Full-time farmer		5	1		6 (14%)	22	4	1	27 (56%)
Part-time farmers	Tractor operator (Large tractor owner)	1			1				
	Driver (Motorcycle owner)	1			1	2			2
	Carpenter	1			1	1			1
	Plasterer	1			1				
	Barber						1		1
	Buddhist image carver	1			1				
	Shopkeeper (foods)					2			2
	Shopkeeper (groceries)					1			1
	Govt. Officials					2		1	3
	Farm laborer (Farm piece-work)	11	15	6	32	6	1	3	10
	Farm laborer (Tractor driving)						1		1
	Wage laborer (Irrigation Department)	1			1				
	Total	17	15	6	38 (86%)	14	3	4	21 (44%)
Sum total		22	16	6	44	36	7	5	48

Mode of land tenure	Number of household	Age of household's head	Land owned	Land occupied	Total (%)	Area of household	Rented out	Rented in	Main-season	Off-season	Dry field	Total
Owner farmer	22	47.8	384.50	144.00	528.50(78.4)	24.02	42.00	10.50	(23.39) 514.50	(2.05) 45.00	86.00	645.50
Owner-tenant farmer	16	45.0	100.75	44.75	145.50(21.6)	9.09	-	144.00	(16.66) 266.50	(2.06) 33.00	56.25	355.75
Tenant farmer	6	46.5	-	-	-	-	-	99.00	(16.17) 97.00	(0.30) 2.00	-	99.00
Farm laborer	4	46.8	-	-	-	-	-	2.00	-	-	2.00	2.00
Others	4	40.0	-	-	-	-	-	18.00	-	-	18.00	18.00
Total	52		485.25	188.75	674.00(100)		42.00	273.50	(16.88) 878.00	(1.54) 80.00	162.25	1,120.25

( )=Area/Household

Table 7 AREA OF LAND OWNED AND OPERATED BY MODE OF LAND TENURE (Hamlet No. 4)

Mode of land tenure	Number of household	Age of household's head	Land owned	Land occupied	Total (%)	Area of household	Rented out	Rented in	Main-season	Off-season	Dry field	Total
Owner farmer	36	42.31	589.00	150.50	739.50(89.9)	20.54	27.00	31.00	(16.65) 599.50	(13.05) 470.00	48.00	1,117.50
Owner-tenant farmer	7	36.43	61.25	22.00	83.25(10.1)	11.89	-	61.75	(19.21) 134.50	(11.43) 80.00	11.00	225.50
Tenant farmer	5	35.40	-	-	-	-	-	40.00	(8.00) 40.00	(8.00) 40.00	6.00	86.00
Total	48		650.25	172.50	822.75(100)		27.00	132.75	(16.13) 774.00	(12.29) 590.00	65.00	1,429.00

( )=Area/Household

Table 8 FREQUENCY DISTRIBUTION OF LAND OWNED AND OCCUPIED BY MODE OF LAND TENURE

Size category	Hamlet No. 5		Hamlet No. 4	
	Owner farmer	Owner-tenant farmer	Owner farmer	Owner-tenant farmer
60.00 -	1			
50.00 - 59.99	2		1	
40.00 - 49.99	1		3	
30.00 - 39.99	4		6	
20.00 - 29.99	3	2	8	1
10.00 - 19.99	6	4	7	4
5.00 - 9.99	4	7	11	2
- 4.99	1	3		
Total	22	16	36	7

Table 9 FREQUENCY DISTRIBUTION OF LAND OPERATED BY MODE OF LANDHOLDING

Size category	Hamlet No. 5			Hamlet No. 4		
	Owner farmer	Owner-tenant farmer	Tenant farmer	Owner farmer	Owner-tenant farmer	Tenant farmer
70.00 -				1		
60.00 - 69.99	1			3		
50.00 - 59.99	2			3	1	
40.00 - 49.99	2			3	1	
30.00 - 39.99	3	2	1	6	1	
20.00 - 29.99	5	4		6	3	3
10.00 - 19.99	4	7	3	12	1	1
5.00 - 9.99	4	3	2	2		1
- 4.99	1					
Total	22	16	6	36	7	5

Table 10 RENTAL BY TENANCY RELATIONSHIPS AND METHODS OF PAYMENT (Hamlets No. 4 and 5)

	Time of payment	Payment in cash (bath)				Payment in kind (thang)		Total
		-100	101-150	151-200	201-	less than 10	more than 10	
Among relatives	Before harvest	1	1	4				6
	After harvest	3	2	3	3	1	2	14
Among non-relatives	Before harvest			5	6*			11
	After harvest			1	2	1		4
Others	Before harvest	2		1				3
	After harvest						1	1
Total		6	3	14	11	2	3	39

(* Including a case in which 3,000 bath are paid before renting for 5 years)

Table 11 FREQUENCY DISTRIBUTION OF FAMILY TYPES BY MODE OF LAND TENURE (Hamlet No. 5)

Family type		Owner farmer	Owner-tenant farmer	Tenant farmer	Farm laborer	Others	Total (%)
S		1					1 (2.0)
NF	NF(y)	8	8	2	2	3	23 (44.2)
	NF(o)	6	3		1		10 (19.2)
SF	SA(m)	3	2	1		1	7 (13.4)
	SA(p)	1		1			2 (3.8)
	SB(m)	2	3	1	1		7 (13.4)
	SB(p)			1			1 (2.0)
	SC	1					1 (2.0)
Total		22	16	6	4	4	52(100.0)

Table 12 FREQUENCY DISTRIBUTION OF FAMILY TYPES BY MODE OF LAND TENURE (Hamlet No. 4)

Family type		Owner farmer	Owner-tenant farmer	Tenant farmer	Total (%)
NF	NF(y)	22	5	4	31 (64.6)
	NF(o)	10			10 (20.9)
SF	SA(m)	2	1		3 (6.2)
	SB(m)	1	1	1	3 (6.2)
	SD	1			1 (2.1)
Total		36	7	5	48(100.0)

Table 13 AREA OF PADDY LAND OWNED AND OCCUPIED BY FAMILY TYPE

Family type		Hamlet No. 5			Hamlet No. 4		
		Land owned (%)	Land occupied (%)	Total	Land owned (%)	Land occupied (%)	Total
S		20.00 (4)		20.00			
NF	NF(y)	103.25 (21)	62.75 (33)	166.00	237.75 (37)	161.50 (94)	399.25
	NF(o)	251.00 (52)		251.00	305.50 (47)		305.50
SF	SA(m)	69.00 (14)	40.00 (21)	109.00	81.00 (12)		81.00
	SA(p)	29.00 (6)		29.00			
	SB(m)	13.00 (3)	71.00 (38)	84.00	6.00 (1)	11.00 (6)	17.00
	SC		15.00 (8)	15.00			
	SD				20.00 (3)		20.00
Total		485.25(100)	188.75(100)	674.00	650.25(100)	172.50(100)	822.75

Table 14 PRODUCTION COSTS FOR PADDY CULTIVATION ACCORDING TO MODE OF LAND TENURE

Mode of land tenure	Hamlet No.5			Hamlet No.4		
	Production costs	Area of land operated	Cost per rai	Production costs	Area of land operated	Cost per rai
Owner farmer	203,716	645.50	316	503,939	1,117.50	451
Owner-tenant farmer	113,131	355.75	318	101,118	225.50	448
Tenant farmer	27,218	99.00	275	38,133	86.00	443
Total	344,065	1,100.25	313	643,190	1,429.00	450

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Farming Technology in the Deep Flooding Area of the Chao Phraya Delta: A Case Study in Ayutthaya

Shigeharu TANABE*

I Introduction

This paper aims to examine the major characteristics of farming technology of rice cultivation in the deep flooding area stretching on the west bank of the Chao Phraya delta, by investigating the data obtained in a specified village in Ayutthaya province.[1] A vast flat delta area subject to long and deep flooding in the rainy season extends from the bank of the Chao Phraya to the Suphanburi river to the west, and from the Phraya Banlü canal to the Phakhai region along the Noi river to the north. This deep flooding belt corresponds to the retarding basin in the hydrographical classification of the delta.[2]

Uncertainty of monsoon precipitation at the beginning of the rainy season and prolonged deep inundation are peculiar conditions relevant to rice cultivation in this area. The difficulties posed by these gigantic and uncontrollable physical environment, despite the recent improvement of water control by the government, have not yet been fully overcome. The peasant farmers, in order to adapt to such rather unfavourable environment, have traditionally developed a peculiar kind of farming technology. That is the broadcast-sowing method together with a suitable choice of indigenous late varieties including the so-called 'floating rice' (*Khao khün nam*). The sophisticated water control which has been widely developed and maintained by peasant cooperative efforts in the intermontane basins of northern Thailand, cannot be observed in this area. However, the

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1) The field work on which the paper is based was undertaken in 1974–75 with further short visits in 1977, 1978, 1979. Grateful acknowledgement must be extended to Mr. John Sargent, Reader in Geography and Dr. Andrew G. W. Turton, Lecturer in Social Anthropology, School of Oriental and African Studies, University of London, for making many helpful comments and corrections on an earlier draft. My acknowledgement must be also to Professor Yoshikazu Takaya and Professor Yoshihiro Kaida, the Center for Southeast Asian Studies, Kyoto University, for providing many useful ideas and information relevant to this paper. My thanks are due to the Japan Foundation for sponsoring the research in London.

2) For the classification based on the hydrographical conditions of the delta, see Kaida's detailed analysis [Kaida 1973: 403–413; Kaida 1974: 512–524]. The relationship between topographical condition and rice-growing in this delta is discussed in Takaya's pioneer work [Takaya 1971: 375–379].

broadcast-sowing cultivation as a traditional farming technology is highly efficient and rationally adapted to the existing physical environment. Meanwhile, the early season cultivation, by the transplanting method of newly improved varieties introduced in recent years, requires heavy investment of both capital and labour. The new technology together with power devices and industrial inputs has had a considerable effect on the traditional farming system. However, a series of inter-linked technological decisions which has appeared in the course of farming operations still shows strong characteristics of a peasant economy. It can be considered that Ayutthaya's farming technology has been basically developed within a peasant economy, though it has survived for many decades despite the penetration of the rice market economy.

The purpose of this paper is to examine these characteristics of the traditional farming technology as applied in a selected village of this delta region. The settlement referred to hereafter as 'Ayutthaya village,' is in fact Village No. 9 (*mu kao*) of Tambon Bang Nomkho, an administrative unit which consists of ten villages along the Khanomčhin canal and the Noi river, in the Sena district of Ayutthaya province. The village stretches along the canal in a discontinuous linear type of settlement, and is about 6 km from the town of Ban Phaen where the district office of Amphoe Sena is located. The villagers have easy access, by both water and road traffic, to Ban Phaen, Čhao Čhet and Sikuk, all of which are local rice trading centres along the Čhao Čhet—Bang Yihon canal and the Noi rivers (Figure 1).[3]

Although the northern part of Tambon Bang Nomkho close to the Noi channel has a long history dating back to the Ayutthaya period (1350–1767 A.D.), Ayutthaya village was established as a result of relatively new reclamation. The pioneering settlement, precursor of the present village, is believed to have been just established at the earliest with the encroachments of clearing along the Khanomčhin canal at the close of nineteenth century.[4] In the 1890s, gradual but steady migration into the village began, as a result of the search for new frontiers of rice cultivation.[5] Some migrants came from the north,

3) A huge number of rice cargo boats, sail down the Čhao Čhet—Bang Yihon canal and the Noi river from Suphanburi and Phakhai regions, and often stop over at a row of rice mills at those centres for the purpose of selling or trans-shipment. Most of these cargoes are sold to the rice mills directly and are later transported to Bangkok by the larger boats through the Noi and Chao Phraya main channel. For rice trading and its market practices in Ayutthaya province, see [Pricha 1971: 171–213].

4) The rapid development of rice cultivation in this area is referred to in Phraya Boranratchathanin's contemporary description [Boranratchathanin 1962: 11–12].

5) Most peasants claimed their ownership to the cleared land, while some of them were tenants renting riceland from landlords who also operated at the beginning of the pioneering days. It should be noticed that some tenants cultivated *na luang* or royal riceland under the ownership of the King. A detailed discussion of the *na luang* and the process of reclamation in this area is given in [Tanabe 1978: 72–82].

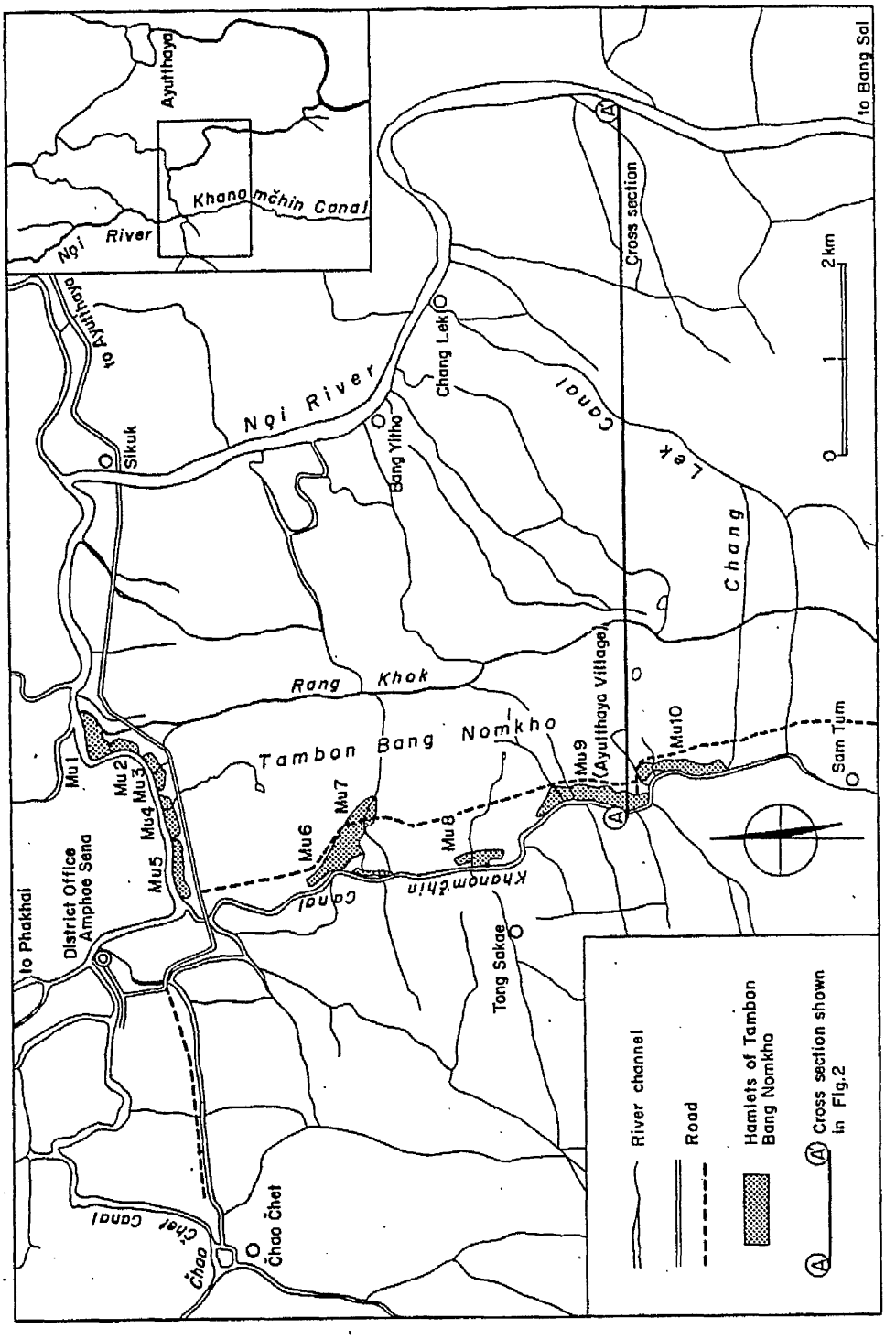


Fig. 1 Ayutthaya Village

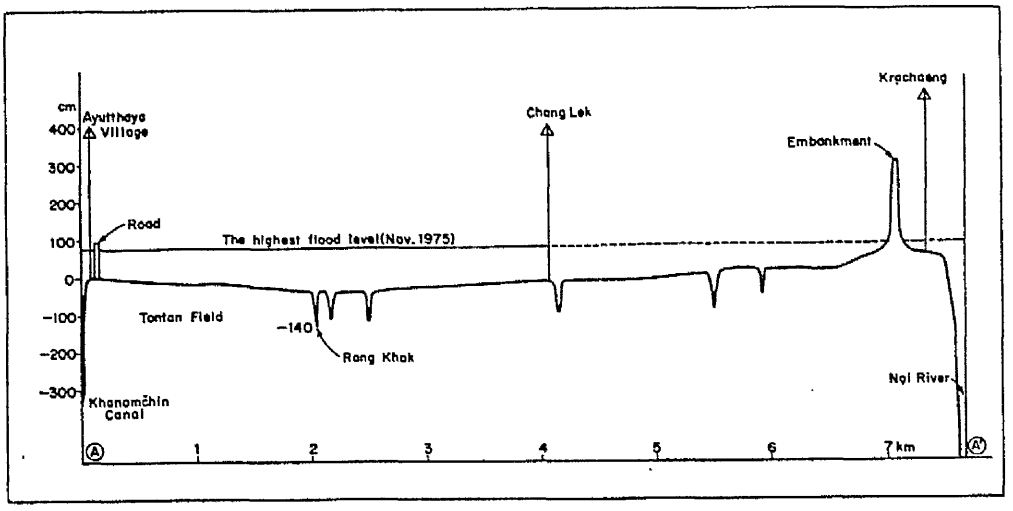


Fig. 2 Profile of the Cross Section Ⓐ–Ⓐ'

and from centres such as Ban Phaen, Čhao Čhet and Sikuk as well as the northern part of the Khanomčhin canal. The claiming of ricelands by peasants came to an end at least by the 1920s, and tenancy has steadily increased up to the present.

The Tambon Bang Nomkho contains 573 households and a population of 3538. In 1975, Ayutthaya village was the largest of the ten villages, with 83 households and a population of 378. The households of Ayutthaya village consisted of 67 farming households including 21 households of rural labourers who are almost landless and work mainly as hired labourers on farms and in other jobs, and 16 non-farming households. There are 48 households engaged in rice cultivation mainly inside the village area.[6] The main rice field, called the Tontan field, extends from the canal to the Rang Khok, a narrow and crooked drainage water course in a depression. The annual flooding from the canal into the Tontan field normally begins in late August. Owing to the heavy rainfall in the following months, flood water overflows the relatively low natural levees on which settlements are found, into the field, and the highest floods can raise the water level to over 1.5 m from ground level. The inundation continues until mid-December and gradually subsides in harvesting time (Figure 2).

In the following section of this paper, the water conditions, which represent the most crucial factors in the technology of rice cultivation, will be analyzed in relation to the development of water

6) The 44 households including 6 landlord-operators, 7 owner-operators, 13 part-owners and 18 tenants were subject of the detailed survey relating farming technology; there were also 4 households of rural labourers who cultivated small areas less than 5 rai (1 rai= 0.16 ha). The total amount of operated area was 1233.00 rai (197.28 ha) consisting of 719.75 rai of area owned and 513.25 rai of area rented in.

control under government projects. This will be followed by the section dealing with land-use patterns and farming practices of both traditional broadcast-sowing and newly introduced transplanting methods. The paper will subsequently examine the material culture of farming, and decision-making, the two elements of which farming technology essentially consists.

II The Development of Water Control

1. Inundation and Rice Cultivation

Water control in rice cultivation in Ayutthaya village is different from those techniques in use in the intermontane basins where people can get a relatively stable water supply to the fields by means of the traditional gravity irrigation works. In Ayutthaya village, seasonal rice cultivation is predominant and its broadcast-sowing method is essentially dependent on local rainfall on the fields at the early stage of cultivation in the latter half of April and May. Subsequently, it is affected more or less, by the inundation caused by annual flooding during the extended period of rice-growing from July onwards. Therefore, in the first place, rice cultivation is strictly determined by the localized rainfall pattern during land preparation and sowing. If the rainfall is insufficient or comes too late at this crucial period of sowing, cultivation is impossible, or late sowing can result in young plants being drowned by the sudden torrential rainfall and the first rise of inundation water. At the same time, cultivation has to rely upon the inundation which used to be unstable due to the localized heavy rainfall and occasional spilled water throughout the latter half, the reproductive growth period. The inundation occurs on a vast scale, being caused by drained water from an enormous catchment area upstream. In the absence of authority powerful enough to organize and carry out large-scale hydraulic works, control of inundation by the villagers would be altogether impracticable[7] [Wijeyewardene 1973: 89–110; Ishii 1978: 18–19, 26]. In hydrographic terms, the ricelands of the village on the east bank of the Khanomčhin canal are situated in the southern part of a huge retarding basin extending from Phakhai to the Phraya Banlü canal along the Noi channel. The retarding basin, having an average elevation of ca. 2 m above mean sea level, is subject to deep and long flooding by the drained water from the Old Delta upstream [Kaida 1974: 512–513]. The most marshy depression can be seen

7) In the premodern period, the government concern was generally focused on the development of communications through the construction of large-scale canals [Tanabe 1977: 64–67]. However, during periods of stable political control, the government maintained a certain level of interest in hydraulic works for water control of ricelands. According to a source dated 1843, construction works were carried out to shut canal sluices in order to protect the rice fields from incipient flooding in the areas close to the Khanomčhin canal, by officials of the Ministry of Agriculture (*krom na*) and the governor of Krung Kao (Ayutthaya) [Krom Sinlapakon 1969: 17–18; Tanabe 1978: 31–32].

around the Lat Chado swamp area west of Phakhai, where cultivation has suffered much loss in the past hundred years from extraordinary flooding.[8] The inundation prevails all over the area of the retarding basin and can last for a period of more than 30 weeks, which roughly corresponds to the entire growing period of broadcast-sown season rice [Kaida 1973: 405]. Under ordinary circumstances, the highest level of inundation attains 1.5–2 m on the fields in October and subsequently subsides November, and towards December. This prolonged stay of inundation water may be partially due to the slight elevation along the Phraya Banlü canal running transverse to the Chao Phraya and the Suphanburi main channels.[9] The inundated water, after remaining for a considerable period, flows down into the main part of the West Bank project area over the Phraya Banlü canal southward, from which more favourable and stable water conditions for rice cultivation may be observed. The Čhao Čhet-Bang Yihon project area in which the Khanomčhin canal area is included, falls within the northern part of the West Bank project scheme, and is subject to water control carried out by the Royal Irrigation Department (RID). Nevertheless, hydrographical conditions here seem to be much similar to the depressions around the Phakhai area.

Under such circumstances, peasants of the village who have traditionally adopted the cultivation of floating rice as their only feasible crop, developed no sophisticated water control system comparable to that of the intermontane basins. Nevertheless, there have been some attempts to alter the condition of the land. During the pioneering days of the settlement, a small tertiary canal was dredged so as to lead inundation water into the fields. This was the Tontan canal, which, with a length of about 2 km, linked the Khanomčhin canal with the Rang Khok drainage channel to the east. Although the precise year of excavation is not clear, it is said that the work was done at the beginning of this century, by the co-operative labour of peasants who worked plots in the Tontan field, the main field of the village stretching along the east bank. After its completion, though the tertiary canal served the purposes of irrigation and drainage to some extent, no other public works to improve water control were undertaken by the villagers. Water control works to facilitate rice-growing, which include irrigation, drainage and flood control, were not accomplished until the government decided to initiate and carry out a project under the RID.

8) Prince Damrong gives a brief account suggesting the presence of traditional early season cultivation before the deep flooding season around this swamp at the close of the nineteenth century [Damrong 1972: 3]. However, the cultivation of so-called 'floating rice' has been predominant in this area [Sukit 1969: 3].

9) According to personal communications with Professors Takaya and Kaida. Also see [Takaya 1969: 25–26; Takaya 1971: 391–392].

2. Water Control under the Government Projects

On the west bank of the Chao Phraya several trunk canals transverse to the Suphanburi river were already in existence at the end of the nineteenth century, when the Ministry of Agriculture dredged the Khanomčhin canal under the leadership of Phraya Kasetraksa to provide easy access to the uncultivated wilderness [Tanabe 1978: 78]. Those include, for example, the Čhao Čhet-Bang Yihon canal and Phraya Banlü canal in the area concerned. Although these canals led to an improvement in water transport between the two major channels, and to some extent stimulated the expansion of ricelands along them, at the same time, they often caused obstruction to drainage in the depressions [van der Heide 1903: 25]. Van der Heide, a Dutch irrigation expert from Netherlands East Indies refers to such conditions in this area in his report in 1903 as follows:

> "Moreover the dykes of excavated earth along the *klongs* [canals] add no small part to the natural obstructions against drainage and so at the time the water in the rivers and in the *klongs* is rising to the highest level and rainfall is still heavy, the very lowest parts often become flooded for some time as deep as 2 m and more. In these conditions only *na müang* paddy [floating rice] can be cultivated." [van der Heide 1903: 47].

The river and canal systems, thus described, and the expansion of riceland in the Khanomčhin canal area are shown in Figure 3. As far as the Tontan fields are concerned, the wilderness had almost disappeared by 1906, except in the area southward along the Rang Khok. Although most of the areas westward from the Khanomčhin were still left uncultivated in that period, they too were transformed into ricelands by the 1920s.

In 1903, van der Heide drew up a highly ambitious master plan for a water control scheme covering the whole of the Chao Phraya delta. Three years later, he proposed a smaller and more moderately designed project scheme on the west bank [van der Heide 1906]. According to his official report, submitted by the Minister to the throne, the proposed West Bank scheme was part of a greater project which aimed to expand ricelands up to 500,000 rai on the west bank of the Chao Phraya. This was to be achieved by water control with two main feeding canals; one from the Khanomčhin to the Maenam Qm canal north of Bangkok, and another from Bang Yihon to the Mahasawat canal along the east bank of the Suphanburi river (Figure 4). The former, with a total length of 48 km, was to be excavated from the site of Wat Manwichai of Ayutthaya village, then called Wat Prachanman, linking with the existing Khanomčhin canal. Locks and head regulators, one of which was to be installed at the mouth of the Khanomčhin channel, would perform the function of controlling inundation and would secure a stable supply of irrigation water to the fields. And during

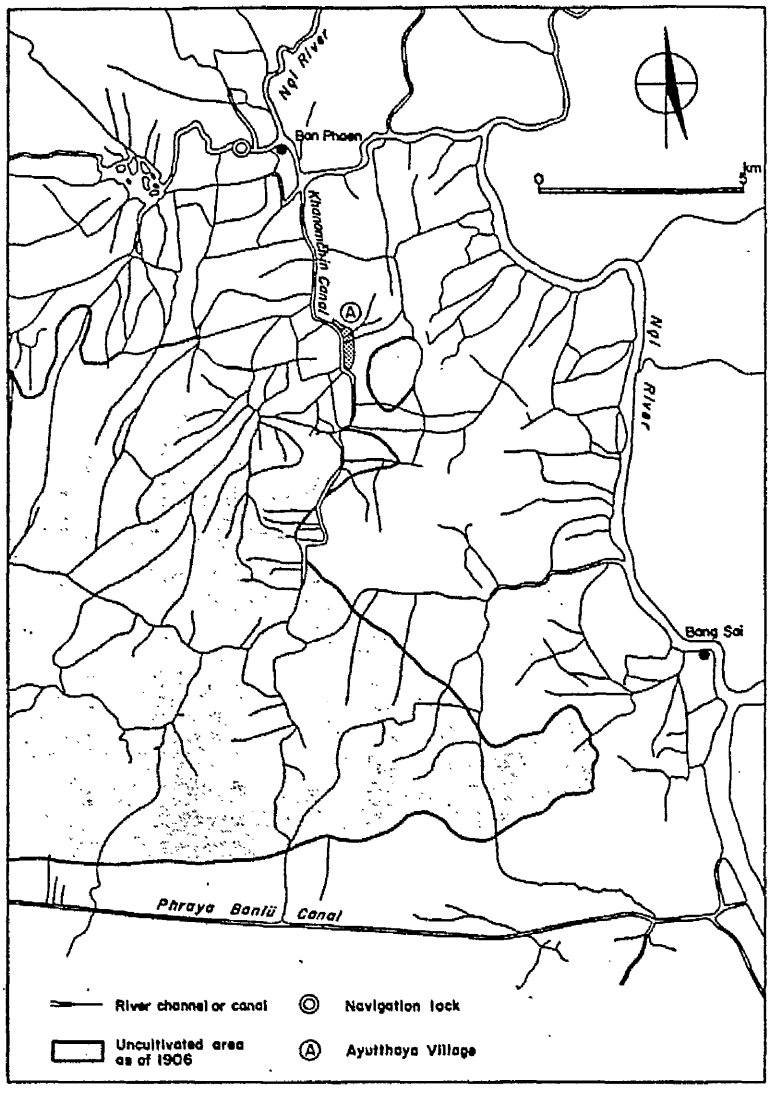


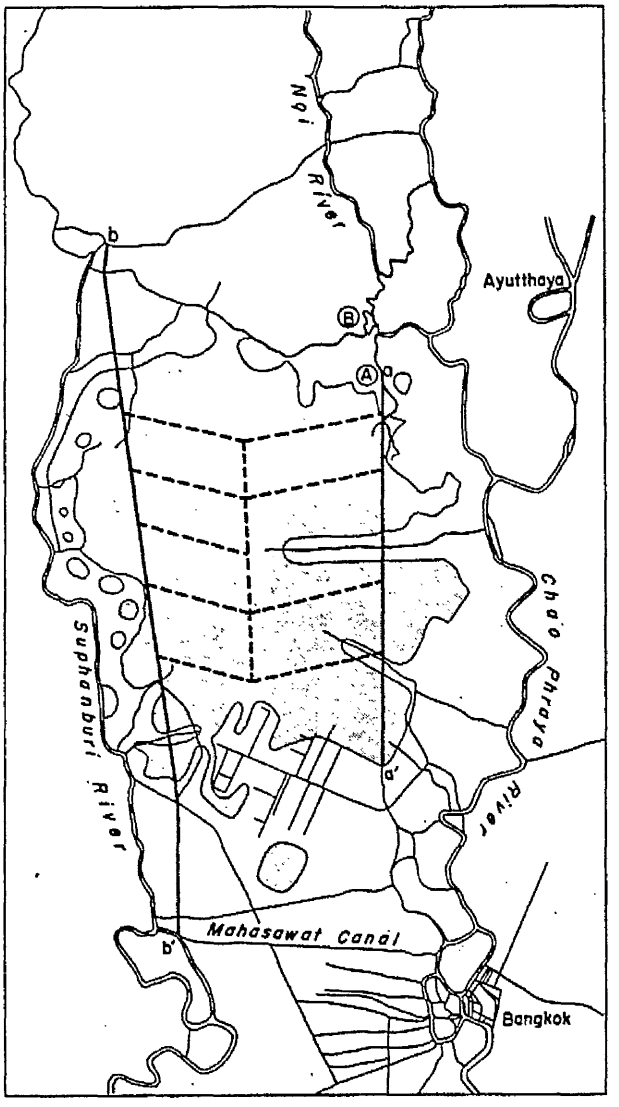
Fig. 3 Water Control within the Khanomchin Canal Area as of 1916

the flooding season,

> "although the flooding on the fields along the Sikuk river [the Nọi river] goes as deep as about 1.5 m, the depth of inundation along the newly excavated canal will be kept within limits of 0.40 to 1.20 m." [van der Heide 1906]

It was intended that this magnificent scheme for water control on the west bank thus proposed would be completed, and in operation to the full capacity required, within eight years. The total cost of the scheme was estimated at about 3 million baht,[10] and if compared

10) In this period, £ 1 was approximately equivalent to 17 baht [van der Heide 1903: 115].



a—a' : Proposed alignment of the West Bank main canal

b—b' : Proposed alignment of the Suphan main canal

– – – – : Proposed alignment of branch canals

▭ : Uncultivated regions concerned

Ⓐ : Ayutthaya Village

Ⓑ : Ban Phaen

From: van der Heide. 1906 (2449). Raingan khut khlong fang tawantok maenam chao phraya. K.S. 9.2/48. Archives of the Ministry of Agriculture in the Fifth Reign. Bangkok: The National Archives.

Fig. 4 The Proposed General Plan of the West Bank Scheme

with the total expenditure of about 57 million baht required for his proposed Greater Chao Phraya project, would cost only five per cent of the latter [van der Heide 1903: 125]. Nevertheless, the government decided to postpone the West Bank project as well as the larger water control scheme, and instead opted for the less expensive "reduced capacity project" in 1906 [Thailand 1915a: Vol. 3, p. 19]. The main reasons for the postponement seems to be the question of how to populate the area, even if conditions were suitable for clearance as a result of the proposed water control, as well as the heavy expenditure required to complete the project [Thailand 1915a: Vol. 3, p. 19; Thailand 1915b: 1–4; Small 1973: 4]. In any case, the water conditions in Ayutthaya village could not be improved to any extent for a long time, because the projects concerning the west bank had fallen into neglect. After van der Heide's resignation from the Department of Canals (*krom khlong*) in 1909, a series of smaller schemes such as the Suphan and Pasak projects together with the improvement of the existing trunk canals was carried out from 1913 onwards under the recommendation of

a British irrigation team headed by Sir Thomas Ward. In the area concerned, some locks were installed to facilitate navigation, and dredging was carried out in the Čhao Čhet - Bang Yihon canal in this period [Thailand, 1915a: Vol. 3, p. 31; Boranratchathanin, 1962: 11]. However, the government paid little regard to the improvement of water conditions in the Khanomčhin canal area until the establishment of the West Bank project in 1939 [Thailand 1927: 3–7].

More than three decades passed before van der Heide's proposal for the West Bank project was revived. Initially, this plan aimed to supplement the natural drainage system with newly excavated canals such as the San canal which runs parallel with the Khanomčhin canal to the west. These canals, it was hoped, would reduce the high levels of inundation caused by occasional heavy rainfall and by spillage of excess water. At the same time, as a result of the expansion of ricelands into the wilderness, a more stable water supply began to be required for the early period of cultivation when the local rainfall is still unreliable. In order to make use of the water in the canals to meet such demand, some regulators and sluices were constructed for the conservation of irrigation water. In addition to these works, embankment and reinforcement of the natural levees along the Chao Phraya, Nọi and Suphanburi rivers were undertaken as flood prevention measures. Thus water control in the project can be characterized by water conservation with flood protection to secure water for the early period of cultivation [Sukit 1969: 1–2]. Although these improvements and constructions slowly continued even after World War II, the water supply during the first half of the cultivation season was still inadequate and unreliable. Sufficient water could not be given to the areas through the upstream channels such as the Nọi and Suphanburi rivers until the completion of the Chao Phraya diversion dam at Chainat.[11]

The Chao Phraya diversion dam, which had been expected to occupy a key position in the Greater Chao Phraya scheme covering the delta region since van der Heide's proposal in 1903, was at last completed in 1960, and began to supply water through the Nọi channel to the West Bank tracts from 1961. Feeding the tracts with water at 105 cubic meter per second, it contributes to some extent to the supply of water during the early stage of cultivation. At the same time, two big feeder canals were newly excavated in the 1960s: the Phokhọi - Bang Yihon canal from the Suphanburi river to Bang Yihon and the Phakhai - Čhao Čhet canal from the Nọi river to Čhao Čhet. These feeder canals, although principally intended to prevent flooding further downstream by dispersing the excessive water from the two main rivers, provided a relatively ample supply of water in

11) FAO Mission for Siam and some official reports of the Ministry of Agriculture well describe the water conditions of the area before completion of the Chainat dam [FAO 1948: 58–59; Thailand 1950: 46–50; Thailand 1957: 146].

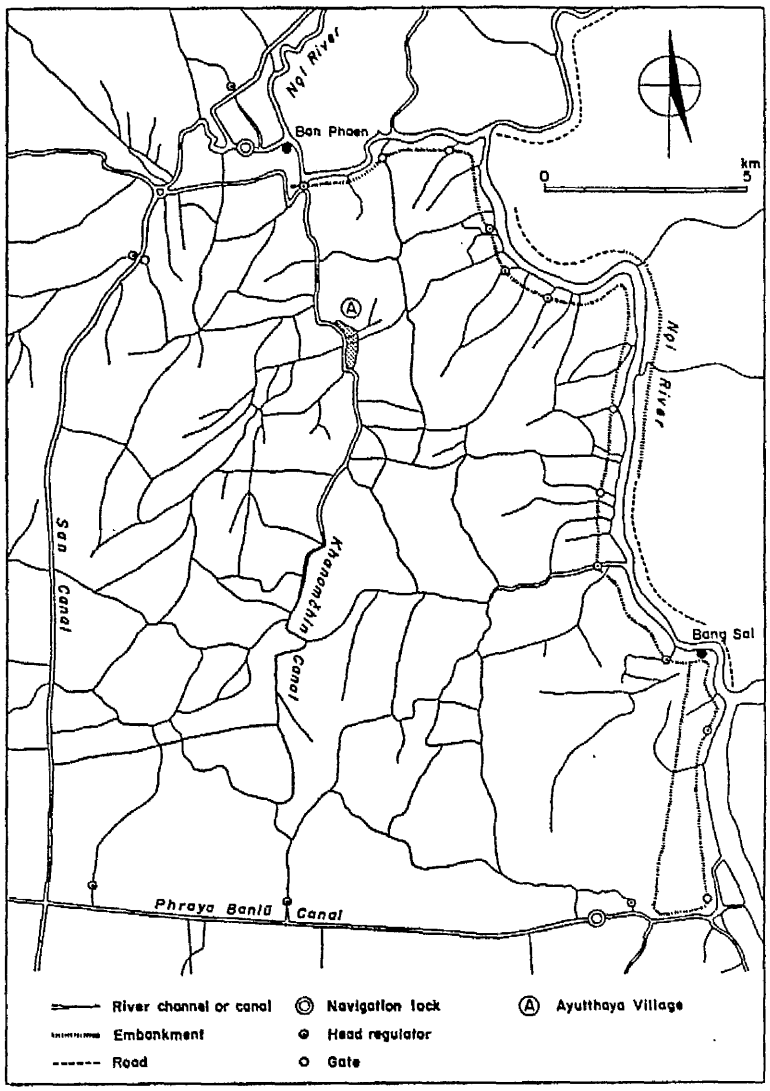


Fig. 5 Water Control within the Khanomčhin Canal Area as of 1969

the dry season as well as in the rainy season [Kaida 1974: 520–521].

In addition to the feeder canals, numerous lateral and tertiary canals constructed since the 1960s up to the present, have provided fairly favourable conditions for transition from the traditional broadcast-sowing method to the transplanting method. In the extensive areas relatively close to the canals, in fact, a remarkable transformation of cropping patterns has taken place since the late 1960s [Sukit 1969: 6–7]. The early season cultivation which is in practice an application of the newly developed non-photosensitive varieties,

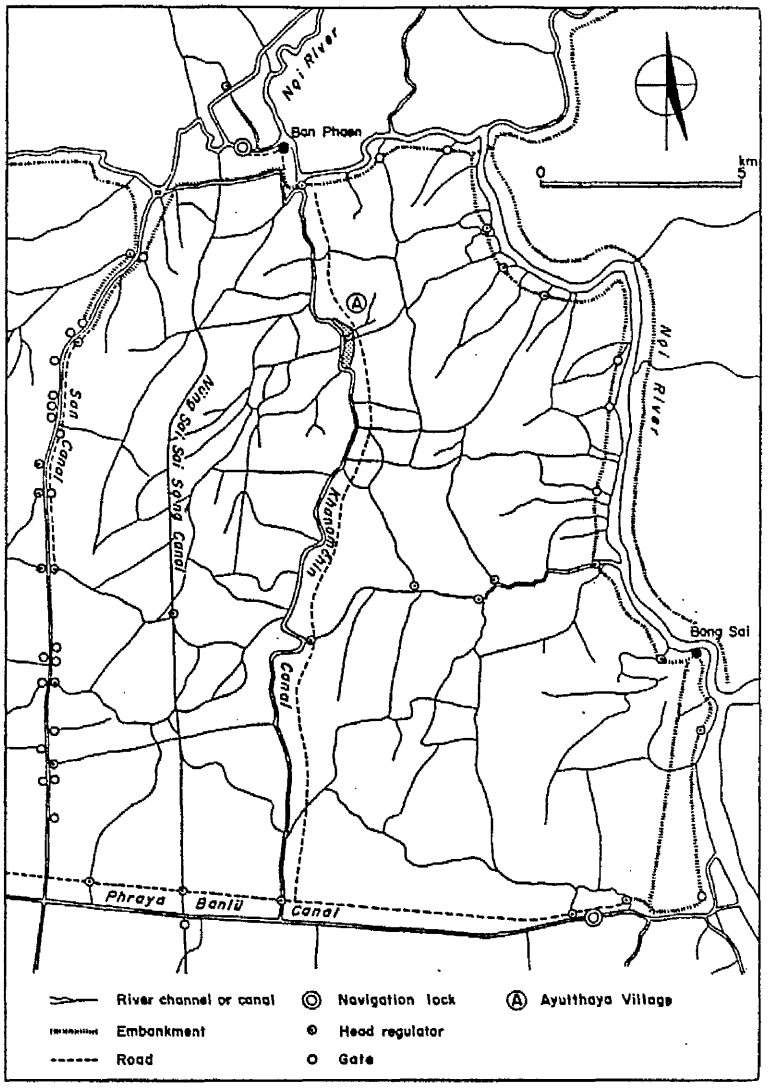


Fig. 6 Water Control within the Khanomchin Canal Area as of 1977

such as the RD series, to the first half of the main season cropping, starts in April or May and is harvested in August or September by the time deep inundation occurs.[12] Double cropping has also been partially introduced, particularly in the area close to the canals where the water is available even in the dry season.

These remarkable developments, caused by the recent improvement of water control have taken place, however, in the southern parts of the West

12) The recent transformation of cropping pattern chiefly caused by the wide-use of low lift pumps as well as by the implementation of water works [Kaida 1974: 523–524].

Bank tracts downward from the Phraya Banlü canal. Most areas in the northern parts of the tracts in which Ayutthaya village is situated still continue under the traditional broadcast-sowing cultivation adapting to the deep inundation. Despite the implementation of water control which is certainly progressing as shown in the Figure 6, the deep inundation and its relatively early occurrence does not yet allow transplanting cultivation around Ayutthaya village. As far as the Tontan field on the east bank of the Khanomčhin canal is concerned, the water conditions still make it impossible to adopt the extensive cultivation of transplanted rice. The field is too deep to adopt early season cultivation, and has an insufficient water supply to commence dry season cultivation. The attempt to drain the excess water through the Noi river in order to encourage early cultivation can cause the unexpected flooding of the Chao Phraya main channel further downstream near the Bangkok metropolitan region [Thailand 1978: 3]. Therefore, broadcast-sowing cultivation depending on rainfall is still necessarily practised in the village. And the introduction of early season cultivation by the transplanting method is strictly limited to the area immediately adjacent to the Khanomčhin canal.

Under such circumstances the RID has recently made efforts to enable stricter water control in the subdivided areas in the northern part of the West Bank tracts [Thailand 1978: 1–2]. The area surrounded by the Čhao Chet-Bang Yihon canal, the Phraya Banlü canal, the Suphanburi, and the Noi river became a subdivision named the Čhao Čhet - Bang Yihon project (*khrongkan songnam lae bamrungraksa čhao čhet bang yihon*). In order to keep the project area under more effective control, embankments together with roads have been constructed along the main rivers and canals surrounding the area. Newly excavated canals and numerous natural water courses are connected with the outer channels by the head regulators installed across the embankments. The project area is again subdivided into three zones, demarcated by major feeder canals. Each zone is surrounded by embankments or dikes of excavated earth along the canals together with a number of regulators as in Zone No. 1 shown in Figure 6. Through such construction works in progress, water conditions around the village will be more stabilized, and as a consequence, transplanting culture conducive to an improvement of the environment might emerge under a new cropping pattern in the traditional broadcast-sowing culture region.

3. Operation and Maintenance of Water Control in the Village

The water control scheme thus developed is directly operated and maintained by the RID. The State Irrigation Schemes such as the Čhao Čhet-Bang Yihon project, different from the rather small People's Irrigation Schemes constructed and maintained by the water

users concerned, are managed under the complete control of the RID through its bureaucratic organization. Under huge and complicated water control systems such as the Greater Chao Phraya scheme, water allocation into even a lateral canal is taken into account within the total plan of water distribution. Because the water conditions in one project area are systematically affected by those in other areas, localized water control would be impossible. Therefore a highly centralized management system has been adopted throughout the area covered by the Greater Chao Phraya scheme. On the other hand, where operation and maintenance of the facilities is concerned, the peasants' participation as water users is still minimal by and large. In some areas in the Old Delta upstream where the water supply has always been sufficient and stable and dry-season cropping is being operated, the peasants have developed fairly good maintenance of lateral canals and farm channels [Small 1974: 694; Kaida 1978: 231]. However, it is widely observed that the peasants' co-operation as well as their participation is generally lacking in the maintenance of the facilities in most of the project areas in the delta [Small 1974: 692].

In the case of Ayutthaya village, the operation of water control is organized outside the village. The Khanomčhin canal, the indispensable main channel for irrigation and drainage in the Tontan field, is regulated by the two head regulators installed at both ends of the canal. The operation of both regulators is under the control of the two zone-men or *nai truat chonprathan luang* under the order of the Čhao Čhet - Bang Yihon project office at Singhanat, the mouth of the Phraya Banlü canal. The zone-man, an official for the smaller unit of operation appointed by the RID, has as his main duties: to control the amount of water in the canal through the head regulator, to report water level and other data to the office, and to supervise the maintenance of the canal.[13] The zone-man who is engaged in the actual operation of water control, is also expected to keep in close contact with the peasants and to collect cropping data in the area concerned. However, the relationship between the zone-men and the villagers is not so well-established and the latter recognize them only as officials who administer the operation of canals and no more. In the areas where more efficient water control is achieved by the construction of lateral canals and ditch-and-dike networks, ditch riders or *nai truat na* are appointed in the smallest irrigation units to coordinate co-operative activities and transmit peasants' requests for irrigation to the zone-man.[14]

13) Since the canals are fully utilized in daily communication, maintenance of water traffic is one of the main duties of the zone-man.

14) Even though in the sufficiently improved areas, peasants' inadequate behaviour and lack of co-operation often cause damage to field ditches and lateral canals. Frutchey points out such maintenance problems in her survey of the Sam Chuk project area in Suphanburi province. In the area, some farmers allow buffaloes to walk and wallow in ditches while other farmers plant rice in them [Frutchey 1969: 103, 152].

But the area along the Khanom-čhin canal has not yet improved sufficiently to have a ditch rider which would be necessary in a sophisticated water control area. In the Tontan field the deep and prolonged inundation has still not been overcome despite the fact that inundation has been stabilized to some extent through the recent improvements. At any rate, the villagers appear to have neither satisfaction with the present water conditions nor any incentive to participate in the maintenance of water control. It may even be said that, at the moment, they are rather indifferent to the official management of water control.

The village does not contain a single peasant organization relating to the maintenance of canals and other water control facilities. Nor is there anyone who individually joins such organizations outside the village. Apart from the earlier example of small canal dredging during their pioneering days, co-operation in water control has been rare among the villagers. In the delta region, by contrast with the northern intermontane basins, an indigenous co-operative organization of water control has hardly been developed at all.[15] Nevertheless, since the late 1960s, the RID has been making efforts to establish and foster the Water Users' Association or *samakhom phu chai nam chonprathan* among the peasants involved in state irrigation projects throughout the country. It aims to achieve an appropriate water allocation in the users' plots through co-operative maintenance of facilities, and to encourage the most suitable cropping patterns to adapt to the improved water conditions [Metha 1978; Vanpen 1978: 11–15]. However, such attemps to create co-operative organization among the peasants have not been very successful in the deep inundation regions. For the moment, no Water Users' Association has been established in Amphoe Sena or Amphoe Phakhai [Ayutthaya 1970: 20].[16]

Thus the water control projects undertaken by the government have operated and are maintained almost without the peasants' involvement at least in the case of Ayutthaya village. At the present stage of the Čhao Čhet - Bang Yihon project which cannot bring about a satisfactory solution to the deep inundation problem, the villagers have little incentive to participate in water control. However, when as a result of improvements lateral canals are provided, the villagers will have no alternative but to organize co-operative activities. In a few plots immediately flanking the canal some villagers are able to cultivate the early season rice owing to the stabilized water level in the canal over the past few years. However, this is not a result of the improvement of the terminal

15) For a discussion of inadequate social practices and the indifference of peasant farmers towards maintenance of irrigation system in this delta, see [Small 1974: 691–694].

16) Referring to an example in Bang Pahan district, Ayutthaya province, Amyot indicates that the association does not play an important role at the level of individual farmers [Amyot 1976: 80–81].

network of water allocation. The villagers can only just get sufficient feeding water for transplanting from the Khanomchin canal by using the motorized water wheel (*rahat*) or pump (*thǫ sup nam, thǫ phayanak*). Due to the lack of lateral canals and a terminal network of allocation, the expansion of early season cultivation has to be confined within very narrow limits.

Be that as it may, the environment of the delta seems so gigantic and uncontrollable to the peasants that effective water control is assumed to be unattainable. Any necessary large-scale improvements will not be undertaken unless the government launches, constructs and manages them. It can be considered that villagers in such environments tend to dissociate themselves from water control systems which require large-scale hydraulic engineering. On the other hand, they have made much endeavour to adapt to the uncontrollable environments with the aid of farming technology.

III Farming Technology in Ayutthaya Village

1. Land-use Pattern

The resources of Ayutthaya village have been almost completely devoted to the monoculture of non-glutinous rice, mainly to secure subsistence needs for home consumption, though some surplus has been sold on the market. In the Tontan field, under the deep inundation conditions, only rice can be successfully raised for consumption and as a commodity. The original vegetation of the Tontan field and the slightly elevated levee along the Khanomchin canal has almost completely disappeared, as a result of the expansion of ricelands. On this large flat field only a few trunks of *sakae (Combretum)* and *makham* (Tamarind tree; *Tamarindus indica*) are left standing to give working farmers shelter from the intense sunshine. The soil of the field is dark heavy clay which is widely found in topographically low places throughout the Chao Phraya delta, and classified as Gray-black Soil in the Thai Soil Map. Like all clay soils formed under alternating seasons of saturation and intense drying, this soil is characterized by deep surface cracking [Pendleton 1962: 66]. During a considerable period of the year it is saturated with ground water, while its surface becomes solid with cracks after inundation and subsides in the dry season. The solid surface makes buffalo ploughing almost impossible unless the first rain provides adequate moisture. During the rainy season, however, it is said that inundated water from upstream deposits silt and clay, bring plant material and other nutrients in addition to inert leached material [Grist 1975: 30].[17]

With the homogeneous soil condition, the Tontan field exhibits a uniform surface which slopes very gently westward from the natural levee on which the

17) The inundation water which brings nutrients is locally called *nam daeng* (red-coloured water). According to the peasants' explanation the flow of *nam daeng* was reduced due to conservation of water in each water control project area after completion of the Chainat dam.

settlement is established towards the back swamp up to the Rang Khok. Under careful inspection, however, minute differences in relief can be observed throughout the field and even within a single plot.[18] The size of many plots cultivated using the broadcast-sowing method is quite large, varying in area from 5 to 20 rai (0.8–3.2 ha), and their ground level is often uneven. Therefore in the same plot at the beginning of the rainy season, some portions contain stagnant water, while others are dry. Subsequently, of course, the whole area is submerged with rising inundation. Each plot is surrounded and sometimes subdivided by low and coarse dikes less than 25 cm high, which are not designed to conserve water, but instead merely demarcate the boundaries of ownership. The only exception is a small area of transplanting plots along the Khanomchin canal, which have been evenly levelled and equipped with high dikes for intensive transplanting cultivation. By contrast with villages in the intermontane basins, and despite continuous cultivation for decades, the peasant farmers of the village seem to have been unable to improve the physical conditions of the land.

Under such land conditions together with annual inundation, the land assets of villagers have been traditionally concentrated on the monoculture of nonglutinous rice. There has been little possibility of developing cultivation of crops other than main season rice, lasting around 9 months from May to January. Contrasting with intermontane basins where the main season rice is primarily regarded as a subsistence crop, the peasant farmers of the village usually sell a fair amount of their harvest, though they basically retain enough rice for the subsistence requirements of the household. Under the strong penetration of money economy, for most peasant farmers any surplus rice must be sold to purchase other commodities for consumption. Furthermore, there are even some well-to-do households which sell the whole of their rice output and purchase milled rice in the market for daily consumption. In the virtual absence of cash crops suitable for the land and hydrographical conditions, the land-use pattern is strongly inclined to the monoculture of main season rice.

In 1974–75, the total area cultivated by the 48 households of the village amounted to 1,233 rai. Some 44 households, operating 1,223 rai, were surveyed in relation to land-use and other farming details as shown in Table 1. Among these 44, the average cultivated area per household amounted to 27.80 rai, varying between 8 and 60 rai. There is a strong preference for main season cropping on all available areas, in which more than 90 per cent was planted with broadcast-sowing rice and the rest with transplanting rice. With only one exception, all farming households covered by the survey adopted broadcast-sowing cultivation with dry-sowing and/or wet-

18) Transplanted plots must be level in order to conserve flood water.

Table 1 Land-use Pattern in Ayutthaya Village (1974—5)

Cropping pattern	Period of cultivation	Number of households	Area planted rai (%)	Area harvested rai	Area harvested % of area planted
I. Main season cropping					
Broadcast-sown rice					
samruai (dryland sowing)	May-Jan.	43	1,045.75 (85.5)	1,018.75	97.4
phǫloei (wetland sowing)	May-Jan.	9	60.00 (4.9)	60.00	100.0
Transplanted rice					
(Early season cultivation)	Mar.-Sept.	14	117.25 (9.6)	117.25	100.0
Total		66	1,223.00 (100.0)	1,196.00	
II. Off-season cropping					
Transplanted rice					
(Off-season cultivation)	Feb.-Jul.	1	8.00 (0.7)	8.00	100.0
Green gram	Apr.-Jul.	9	38.75 (3.2)	17.50	45.2
Total		10	46.75 (3.9)	25.50	

sowing methods. Transplanting cultivation was additionally practised by only 14 households. The newly introduced transplanting cultivation which occupies a relatively small portion of the operated area in each household is oriented more towards the market than is the case with traditional broadcast-sowing cultivation.

Despite the recent improvement of water control, crop failures mainly caused by drought and flood have occurred, especially in the fields which are broadcast-sown. In 1974, shortage of rainfall meant that around 2.5 per cent of main season rice was damaged by drought after sowing in the broadcast-sown fields. Depending almost entirely on rainfall, without any supply water from the canal, the broadcast-sown fields are constantly vulnerable to water shortage, especially during the early stages of cultivation. Crop failure caused by excessive inundation at the ripening or young plant stages is relatively rare in the Tontan field. According to the statistics of annual rice cropping compiled at the Sena District Office, broadcast-sown rice has been damaged almost every three years, though loss by damage of this kind throughout the district has not exceeded three per cent of the total planted areas.[19] It would seem that in recent years crop failure on this scale has not seriously threaten the peasants' subsistence.

On the other hand, double cropping completely orientated towards the market covered rather less than four per cent of the total operated area. In 1974–5, as far as rice cultivation was concerned, only one household could achieve double

19) Crop failure is surveyed annually in the rice production reports (*baep khao 1, baep khao 2, baep khao 3*) prepared by each village (*mu ban*) and *tambon*.

cropping after the main season cultivation. The inundation pattern is such that main season cultivation is lengthy in duration, lasting as a rule from May to January. Because of this long duration, and the subsequent shortage of water in the dry season, there has been little opportunity for double cropping. During the past few years some households have tried to grow green gram (*thua khiao*) on small portions of land near the settlement after the broadcasting fields have been harvested. However, owing to soil conditions and the uncertainty of rainfall in the growing season the expected yields have not been obtained. Thus the possibility of further development of cash crops in the period after harvesting the main season rice is practically precluded by the physical conditions. Apart from the double cropping of rice, cultivation of vegetables and fruit trees for home consumption is also limited. Attempts have been made to plant vegetables in scanty kitchen gardens, but owing to deep inundation, yields have been low, except for some aquatic plants such as *phak bung (Ipomoea)*. Although villagers fish and harvest some vegetables from the canal banks and fields, the quantity of food so obtained is small, and most villagers have to purchase various kinds of garden produce and animal foods in the market.[20] Moreover, a number of landless rural labourers, amounting to 21 households or 31 per cent of the 67 farming households, have to purchase rice for their daily consumption.

The Agricultural cycle of the village relevant to land-use and inundation pattern is shown in Figure 7. The main season cultivation of the village traditionally begins with the arrival of the first rainfall in May soon after the *wan songkran* or the traditional New Year's Day, and lasts until January or at the latest mid-February when the harvests are ready for sale or storing in the granary. The traditional broadcast-sowing cultivation uses the indigenous late varieties with a long maturation period of 180–250 days, which corresponds almost perfectly with the inundation pattern. Growing in accordance with the rising inundation level from mid-July, they normally survive at the highest water level in November and can be harvested between December and January. The drainage of flood water is accelerated by opening the sluice at the regulator on the 10th December in order to facilitate the harvesting tasks. Although broadcast-sowing cultivation has to depend on uncertain weather at its

20) Poultry and hog raising are also practised but on a very small scale. Apart from rice as the essential source of calories and protein, fresh water fish represents a major contribution to Ayutthaya's diet. Every villager attempts to fish throughout year, but purchases a small amount of fresh, dried and fermented fish during the busy work season and the latter part of the dry season. Some important fermented fish foods are still made at home on a self-sufficient basis; *kapi* (shrimp paste) is made by 35, *pla ra* (fermented fish) by 28, *nam pla* (fish sauce) by 26 households in the 67 farming households. Ayutthaya's diet pattern is not so different from that of Bang Chan in the 1950s [Hauck *et al.* 1958: 17–19; Sharp *et al.* 1953: 185–201, 263–274; Kamol 1955: 22–23, 53–55].

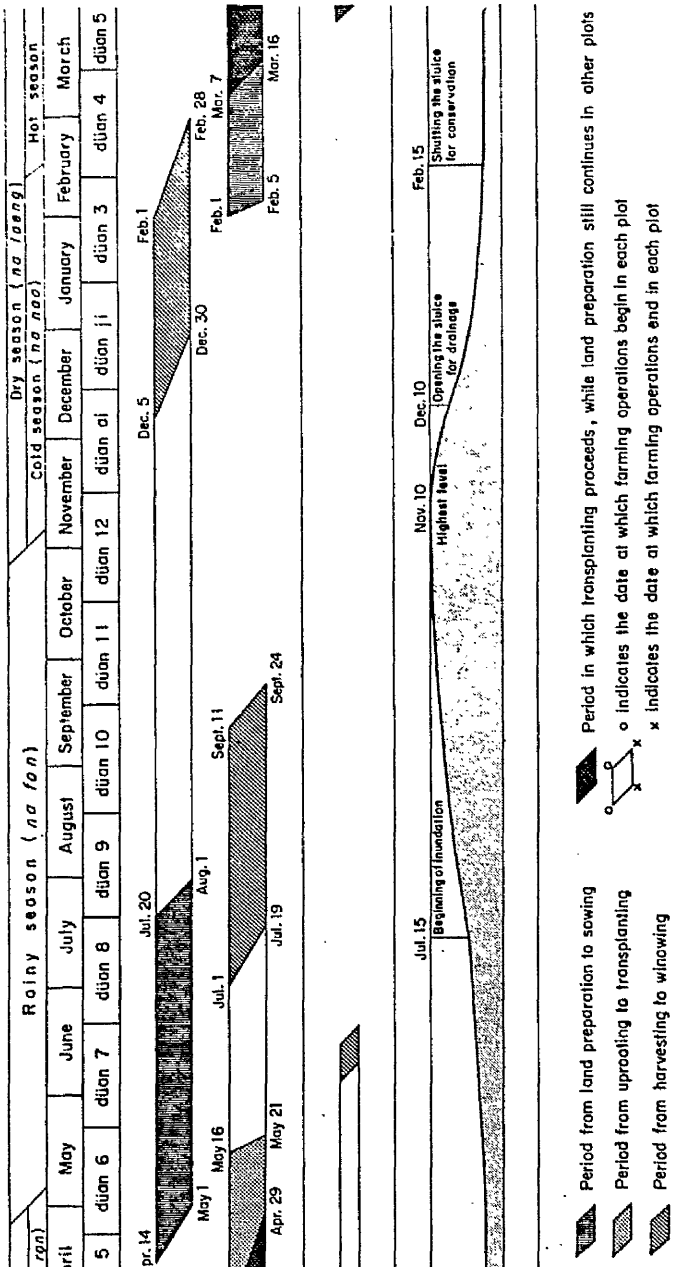


Fig. 7 The Cropping Calendar in Ayutthaya Village

beginning, it is rationally adapted to the existing physical conditions as a whole.

On the other hand, the transplanting cultivation of main season rice has been practised since 1970 when water control was improved. This newly adopted cropping was made possible through introduction of the improved non-photosensitive varieties which were primarily developed as high-yielding varieties with high fertilizer response for double cropping in the dry season.[21] Having non-photoperiod sensitivity and a short maturation period they allow the peasant farmers to commence cultivation from the latter half of the dry season and to harvest before the high inundation comes. Thus the new varieties are accepted not for double cropping after the traditional main season cultivation, but for the early season cropping outside the period of the deep inundation. Because the water level rises after harvesting, subsequent sowing of broadcast rice is practically impossible. The early season cropping with transplanting method commencing in February and March inevitably results in the demand for adequate irrigation for the nursery and the transplanted field. Owing to deficiency of water supply in this season together with the lack of appropriate arrangements for a water allocation network, this kind of cultivation can be only practised in limited plots to which the operators are able to lift water directly from the Khanomčhin canal. Thus the accessibility of plots to the canal is the decisive condition for transplanting cultivation. The operators of the plots have to lift water into the fields by employing the *rahat* with a desel motor or power pump installed on the bank of the canal. In addition to irrigation, the application of industrial inputs such as fertilizer and herbicides, and sometimes pesticides, is also essential in the transplanted fields.

In the cultivation of broadcast-sown rice, little attempt is made to look after the plants before harvesting, apart from some weeding. In the transplanted fields, by contrast, a high input of labour is an essential requirement at every stage of the cycle of cultivation. Because of heavy expenditure on producing costs, and because of the high labour input, the harvest from the transplanted fields is assigned entirely to the market, subsistence rice being obtained from broadcast-sown fields. The peasant farmers of the village cultivate some transplanted rice on the basis of water obtained by power devices. But without the security of enough yields in the broadcast-sown fields from which they obtain their subsistence rice, they are reluctant to alter their traditional cropping pattern.

21) According to Fukui's survey in 1972, the new varieties were being adopted not because of their high-yield potentials, but for their short-period, non-photoperiod-sensitive character [Fukui 1978: 259–262]. In Don Chedi, Suphanburi province, one of the first areas in which those varieties were introduced, farmers engaged in rainfed cultivation did not view the modern varieties as higher yielding than the traditional varieties in 1972 [Jerachone *et al.* 1975: 249–251].

Thus, although farmers have traditionally assigned some of their harvests to the market, it can be said that the land-use pattern of the village need to ensure an adequate output of subsistence rice in the broadcast-sown fields.

2. Broadcast-sowing Cultivation in the Main Season

The long-established traditional method of cultivation is simple and primitive and needs no sophisticated equipment. Nevertheless, it is highly efficient and rationally adapted to the existing physical environment. Broadcasting cultivation is characterised by the extensive cultivation of native late varieties, including the so-called 'floating rice', under prolonged deep inundation. Since it has been traditionally practised for many centuries, broadcast-sowing culture displays a rich and varied terminology. According to the traditional classification of riceland in central Thailand, there are two major categories: *na suan*, or literally garden rice field, and *na müang*, or local rice field. These terms sometimes indicate the rice produced in those ricelands respectively.[22] The *na suan* field was normally cultivated by transplanting method under the favourable water conditions, and the *na suan* rice was believed to be of better quality and especially suitable for export [Suvaphan 1927: 2–3]. The *na müang* field was cultivated exclusively by the broadcast-sowing method in low-lying areas subject to prolonged deep flooding. Having a shorter grain and being inferior in quality, *na müang* rice is likely to have been assigned to domestic consumption, though a great many people actually prefer it to *na suan* rice [Suvaphan 1927: 6]. This classification of riceland and its paddy, however, has recently fallen into disuse. The old terminology has been commonly replaced by more appropriate terms: *na dam* or transplanting field and *na wan* or broadcast-sown field, both of which are directly suggestive of the respective farming methods. The villagers also often speak of *na fang loi* in favourable terms to indicate their broadcast-sown fields, as distinguished from *na dam* practised in the small portion along the Khanomčhin canal. The *na fang lǫi* which may literally means the field of 'floating rice', originally derived from the legal term of riceland taxation in the pre-modern period. As many historical materials suggest, *na fang lǫi* was newly exploited riceland on which the riceland tax (*kha na*) was levied only when the area was cultivated during the year, while *na khu kho*, the first grade riceland under continuous cultivation was subject to payment for the entire

22) *Na müang* is also called *na thung*. Some western sources refer to this classification [Child 1892: 145–146; Graham 1924: Vol. 2, pp. 8–9]. For the traditional classification of riceland and farming technology, the following works are essential [Phichitprichakǫn 1921: 1–22; Suvaphan 1927; Wongsanupraphat 1941: 285–315; Anuman 1965: 129–194]. M.R.W. Suvaphan's brief but informative work was originally published in English, while Anuman's ethnographical study, first published in 1948 was translated into English by William J. Gedney in 1961 [Anuman 1961: 3–59].

area whether it was operated or not.[23] This pre-modern classification is rarely used in application to the present rice-land. Only the word *na fang lǫi* is still alive to imply the traditional broadcast-sown fields of the village, though it has no longer legal implications, but just means *na wan* as distinguished from *na dam.*

In the village context three terms: *na müang*, *na fang lǫi* and *na wan* can be thus recognized as signifying broadcast-sown fields among peasant farmers, though the use of *na müang* is currently disappearing.[24] Despite the fact that these terms imply different ways in which the broadcast-sown fields differ from the transplanted fields, at present they uniformly indicate the broadcast-sown field itself, in which the traditional technology has survived under the almost immutable conditions of the delta. Broadcast-sowing cultivation does not only indicate here a direct sowing method without transplanting of seedlings, but a consistent system of farming technology in which the techniques operated in various stages of cultivation are closely related to each other. It is a series of continuous operations from selection of varieties up to the final stage of production, which has been indigenously developed under conditions of deep inundation. Therefore, its farming technology should be described according to each step of farming operations.

Varieties All varieties raised in the broadcast-sown fields are without exception indigenous photosensitive varieties. As widely seen throughout Thailand, peasant farmers customarily classify them into three categories: *khao phan nak* (late variety), *khao phan klang* (medium-term variety) and *khao phan bao* (early variety) according to maturation period. This classification, though being a local one, seems to be effective in indicating the water conditions in the fields on which suitable varieties may be sown. The late varieties are normally selected for the plots with the deepest inundation water, while the medium-term and the early varieties, though selected to a small degree, may be grown in some slightly elevated fields where the water level is not so deep. Nine broadcast-sowing varieties sown in the village during 1974–75 cropping season are

23) Until the mid-nineteenth century, the *na khu kho* with high and constant yield had only spread to the Old Delta of the upper reaches of the Chao Phraya including Ayutthaya, Angthǫng, Lopburi, and Suphanburi which were under the relatively effective control of the central government. While the *na fang lǫi*, which relied mainly on rainfall and inundation, seems to have been distributed in the newly reclaimed areas all over the delta. The legal application of this classification had been maintained up to the beginning of this century. See the decrees promulgated in 1864 and 1905 [Phrachǫmklao 1968: 162–168; Sathian 1951: 163–167]. Robert Lingat's comprehensive work and Prince Damrong's comment are also useful [Lingat 1940: 32–33; Damrong 1923: 1–7].

24) Another term frequently used is *na pi* or main season rice field in opposition to *na prang* which currently means off-season rice field in general. The *na prang*, however, seems originally to have indicated the traditional early season cultivation. Graham suggests that such a traditional off-season cultivation, though called *khao na trang*, practised at the beginning of this century [Graham 1924: Vol. 2, p. 9].

Table 2 Rice Varieties in Ayutthaya Village (1974—5)

Traditional classification			Name of variety	Harvesting date*	Approximate maturation period
khao fang lǫi khao na mūang	*khao khūn nam* (floating rice)	Late variety	*khao pin kaeo*	Jan. 25—Feb. 5	230—250
			khao phuang nak	Jan. 5—Jan. 20	210—230
			khao sam luang	Jan. 1—Jan. 15	210—220
		Medium-term variety	*khao phuang klang*	Dec. 20—Dec. 31	190—200
	khao mai khūn nam khao kiao kan nam (non-floating rice)	Early variety	*khao phuang bao*	Dec. 10—Dec. 25	170—180
			khao kami	Dec. 10—Dec. 20	170—180
			khao khao ta haeng	Dec. 10—Dec. 20	170—180
			khao hǫ met lek	Dec. 10—Dec. 20	170—180
			khao luang čhaek	Dec. 10—Dec. 20	170—180
Improved variety			RDI (*kǫ khǫ nūng*)	Jul. 1—Sept. 11	120
			C4-63 (*si si*)	Aug. 10—Sept. 5	120

* According to the harvesting of the 1974—5 cropping season

shown in Table 2 with their harvesting date and approximate maturation period. The three late varieties with maturation period of between 210 and 250 days are predominantly adopted in most of the plots in the Tontan field. The cultivation of the medium-term and early varieties which take between 170 and 200 days to reach maturity, tends to be confined to a few plots. However, those maturation periods are not precisely fixed and only indicate roughly the duration of growth. Every villager must always be aware of the approximate harvesting period of each variety, and the important point about this classification is that it is based on a fixed date of ripening. Regardless of a considerably wide range of sowing period owing to the uncertainty surrounding the onset of the monsoon rainfall, the date of harvest of these varieties can be forecasted accurately [Grist 1975: 83–84].

Thus the peasant classification of varieties fully reflects the ripening period; the late variety harvesting between January 1 and February 5, the medium-term variety between December 20 and 31, and the early variety between December 10 and 31. The range of harvesting period of each variety must chiefly depend on socio-economic conditions such as the feasibility of mobilising a labour force during the period. Nevertheless, it can be considered that the harvesting period is strongly associated with the conditions of inundation. Most late and medium-term varieties ripen when the flood water is subsiding, and can be harvested from late December onward after the water has almost drained. On the other hand, the peasant farmers must harvest the early varieties before the flood water is completely drained, though they are planted in rather elevated areas.

With respect to characteristics of the growth habit of varieties, the peasant farmers usually further classify them into

two groups: floating rice (*khao khün nam*) and non-floating rice (*khao mai khün nam*).[25] Three late varieties and one medium-term variety are here identified as *khao khün nam*, while other early varieties are *khao mai khün nam*. As referred to in much of the agronomical literature, 'floating rice' grows, at the internodes of the plant, to keep pace with the rising inundation, and its stem may attain a length of up to five or six meters in order to keep the tip of the plant above water [Ramiah and Ramaswamy 1941: 1–8; Grist 1975: 80, 110, 140–141]. Growing in a rather zigzag fashion under the water and with its tip and some leaves crawling on the surface, the striking habit of *khao khün nam* is often expressed as *fang lǫi* or floating stalk. The growth rate of internodes attains about 5 cm, and sometimes 10 cm per day is recorded [van der Heide 1903: 47; Grist 1975: 141; Kaida 1978: 241]. According to the peasant farmers' observation of the plant, *khao khün nam* must have at least four leaves including the uppermost leaf, or *bai tat hang plathu* (leaf of halved *thu* fish tail) which always remains above the rising level of the flood water.[26] On the other hand, *khao mai khün nam* cannot survive, for its panicle is submerged in extremely deep areas. These non-floating varieties are also called *khao kiao kan nam*, or rice harvesting in the water, because they must be harvested in the still inundated fields, even using boats, before flooding subsides. At any rate, the late and medium-term varieties with the characteristics of 'floating rice' are predominantly selected in most of plots throughout the Tontan field.

Two Types of Land Preparation and Sowing In Ayutthaya village, the broadcast-sowing method can be placed in two categories according to land preparation and sowing which are closely related to the water condition in the plots during the beginning of the rainy season. In dried field plots, the dry sowing method (*samruai*) is employed while in puddled field plots where water is able to come in, the wet sowing method (*phǫloei*) is seen.[27] The *samruai* method is usually practised by sowing the ungerminated seed in the plots where soil is adequately moisturized during preliminary ploughing and sowing. The area adopting this method is quite large, amounting to 85 per cent of the total cultivated area (Table 1). Although the *phǫloei* fields

25) *khao lǫi*, *khao fang lǫi*, and *khao khün nam* all mean, in a vague sense, 'floating rice' grown in extremely deep flooding areas [Wongsanupraphat 1941: 295]. However, the former two may include varieties without a floating habit, according to the region.

26) The panicle emerges from the sheath of *bai tat hang plathu*, which is commonly called 'flag leaf' [Grist 1975: 70; Matsuo 1961: 149]. According to Anuman the rice in panicle formation is thus called *khao klat hang plathu* (rice plant with *thu* fish tail) in Ayutthaya province [Anuman 1965: 154].

27) Both broadcast-sowing methods are widely practised in deltaic environments of Southeast Asian countries [Grist 1975: 141–143]. Like the wet sowing method, locally called *nam tom* in Singburi province, these methods are called by differing names according to the region [Tanabe 1978: 6]. Wongsanupraphat gives a detailed description of these two methods as practised during the fifth reign (1868–1910A.D.) [Wongsanupraphat 1941: 294–301].

are that for broadcast-sown, their appearance resembles paddy fields cultivated by the transplanting method. This is because the germinated seeds are sown in puddled plots resembling the nursery bed of the transplanting method. In many cases, because *phǫloei* plots are in low-lying swampy land, the plots are in a flooded condition during land preparation in April and May. The plots in which the *phǫloei* method is employed occupy only five per cent of the total area. Figure 8 is a cross-section from the Khanomčhin canal to the Rang Khok, showing the relationship between the distribution of the two types of cultivation and the local relief. From a portion of elevated levee along the canal, the terrain gradually slopes downwards towards the Rang Khok with some depressed pockets. Apart from the transplanting fields stretching no more than 200 m far from the bank, the *samruai* field is predominant throughout the entire area. Without exception, however, the *phǫloei* fields lie scattered in depressions where the level of ground water is relatively high and where puddles can be seen in the early and late rainy season. In many cases, a kind of reed, *kok samriam (Cyperus digitatus)* grows in such depressions.[28] Depressions provide good bathing places for buffaloes during the period of water shortage, and during the period of flooding in the rainy season, function as drainage channels.[29] The depth of water in November is around 100 cm on the *samruai* fields, while it attains 150 cm in some depressions of the *phǫloei* field.

For the *samruai* method the first rains are awaited, and ploughing is traditionally done by water buffaloes. Buffaloes have provided the motive power for a long period, but since the late 1960s farm machines have increasingly been in use while ploughing with buffaloes is now disappearing. As shown in Table 3, though power devices such as tractor and power tiller are widely used in land preparation, buffalo ploughing was practised by a considerable number of households in 1974–75 cropping season. In buffalo ploughing of the *samruai* field the traditional task of land preparation is divided into three parts: the rough-ploughing (*thai da*), cross-ploughing (*thai prae*) before sowing, and the cover-ploughing (*thai klop*) to cover the sown seeds with soil [Anuman 1965: 143–150]. The rough-ploughing is done so as to throw up the soil in ridges, and weeds which are turned

28) According to the peasant's classification two typical kinds of reed seem to be simple indicators of water condition; *kok samriam* or *kok rangka*, a perennial weed can be seen only in the depressions where the level of ground water is high throughout year, while *kok hua daeng* or *kok klom* (*Cyperus tegetiformis*), an annual weed may emerge anywhere simultaneously with the growing of rice.

29) Some natural drainage channels called *lamrang satharana* (public water course) are currently preserved as the property of the state. In former times these channels would often function as buffer boundaries between villages. The Rang Khok is such a channel and its depressions containing stagnant water even in the dry season are made use for buffalo bathing, and are called *aeng khwai* or buffalo puddles.

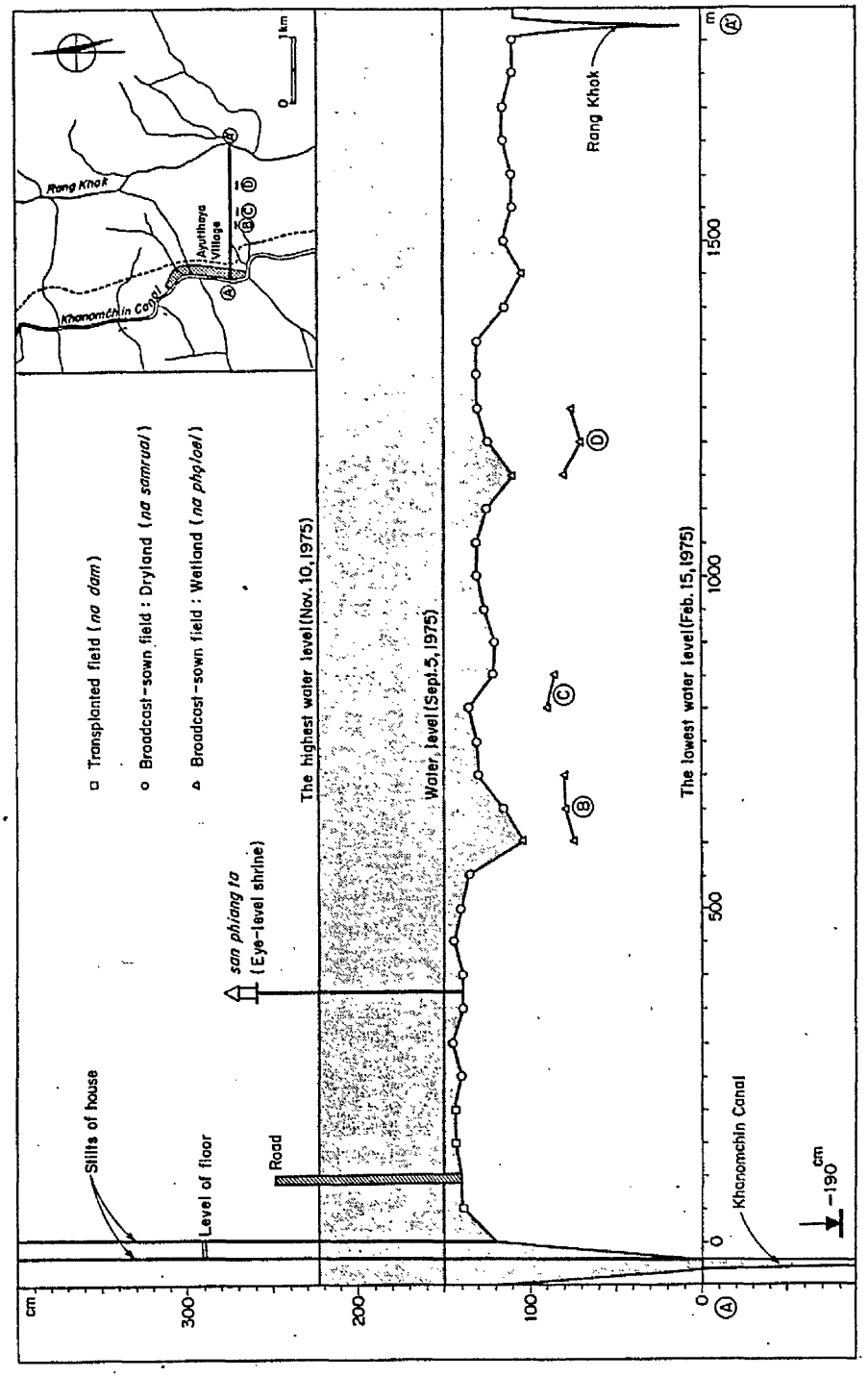


Fig. 8 Local Relief and Type of Cultivation in the Tontan Field

Table 3 Methods of Land Preparation in Ayutthaya Village (1974—5)

Type of cultivation		Rough-ploughing Cross-ploughing	Cover-ploughing	Harrowing Levelling	Number of households
Broadcast-sowing method	*samruai* (Dryland Sowing)	Buffalo	Buffalo		13
		Tractor	Buffalo		13
		Tractor	Power tiller		1
		Power tiller	Buffalo		2
		Power tiller	Power tiller		14
	phǫloei (Wetland sowing)	Buffalo		Buffalo	4
		Power tiller		Power tiller	5
Transplanting method		Buffalo		Buffalo	5
		Power tiller		Buffalo	2
		Power tiller		Power tiller	8
Total					67

over are allowed to rot and fertilize the soil. After rough-ploughing the plots are left alone for many days, and are then cross-ploughed in order to turn the ridges over again. The main purpose of both ploughings is to simultaneously weed and loosen up the soil. The moisturized plots are normally ploughed to an average depth of 4 *niu* (10 cm). A peasant farmer drives a buffalo round to the left and can plough approximately one rai per day.[30]

While the cross-ploughing is proceeding, a peasant farmer has to be ready for sowing. Although when seeds are sown, the surface of the soil may be moisturized to some extent, puddling is not suitable for the *samruai* sowing. Ungerminated seeds kept since the previous harvest are put in a woven bamboo basket (*krabung*), which is hung from the farmer's waist by strings. A peasant farmer walking forward throws up a handful of seed in the air. The average rate of seeding is two *thang* (40 *l*) or about 20 kg per rai; it is twice of the transplanting method and equivalent to 125 kg/ha.[31] Immediately after sowing or at least within a few days, cover-ploughing is performed to turn the seeds under. Some peasant farmers harrow the sown plots in substitution for cover-ploughing.

In addition to the traditional buffalo ploughing, tractors and power tillers are now widely used, especially in rough-ploughing and cross-ploughing. However, cover-ploughing after sowing is usually done by buffalo or power tiller, even though a tractor may have been used previously in preparing the land for sowing in the same plots. A tractor would be too heavy to do such a delicate task after sowing. As none of the vil-

30) Harrowing or *khrat* which is commonly observed in this delta, is seldom practised in the *samruai* fields of the village [Anuman 1965: 151; Kamol 1955: 99].

31) For the rate of seeding in dryland sowing, 85 kg/ha in Bangladesh and 112 kg/ha in central India are reported [Grist 1975: 141–142].

lagers owns a tractor, mechanized ploughing is done by a tractor hired from adjacent villages in Amphoe Sena and even from remote areas such as Amphoe Bang Pain to the Southeast. In terms of wages, ploughing by a hired tractor cost 30–35 baht per rai in 1975. In addition to large tractors smaller power tillers are coming into wide use, and are owned by several households. These power tillers are in general popularly called *khwai lek* (iron water buffalo), and are divided into two types: *rot thai mü*, or two-wheeled tiller pushed by hand and the medium-size four wheeled tiller called *rot thai nang khap*. Large tractors are employed only when extensive areas of *samruai* field have to be prepared before sowing. The smaller devices, by contrast, can be utilized at every stage of land preparation and even in the puddled plots of *phǫloei* broadcast-sowing method and transplanting method. At any rate, as far as farming techniques are concerned, the use of machinery in land preparation of *samruai* fields greatly helps to shorten the period of ploughing; a tractor can cultivate a one rai field in half an hour, while buffalo ploughing takes a whole day or approximately six hours working for the same area.[32] Moreover, tractor and tiller ploughing enable the peasant farmers to begin cultivation earlier than the traditional buffalo ploughing. Farmers relying on buffalo must wait for the first monsoon rainfall to soften the solid surface of the clay soil, and so make ploughing possible. Power devices, however, need not depend on unreliable rainfall, and can be used to start land preparation at any time [Amyot 1976: 117].

The land preparation of *phǫloei* wet sowing field start with ploughing in the puddled soil. In this method, because of flooding at the beginning of the rainy season, large tractors cannot be used, and buffaloes or power tillers are used instead. From plloughing through harrowing into levelling, the land preparation of the *phǫloei* method is the same as that for transplanting method. The ploughing is done several times in the plots on which the water depth is kept approximately 3–4 *niu* (7.5–10 cm).[33] This is followed by harrowing twice or three times in order to remove weeds and break down lumps of clay, so as to obtain a fine mud three or four days before sowing. On the day of sowing, after water is drained off by scooping baskets (*chong long*) or power pumps, the plots are harrowed until level. After this, the surface is finally smoothed with a log of 1.5–2.0 m long and some small ditches are made in order to facilitate drainage. Three days before sowing, seeds are soaked overnight in water contained within an earthen jar (*ong*) and are then transferred to a woven bamboo basket (*krabung*) or roud bamboo crate (*kheng*) covered with straw, and kept in a cool

32) In Bang Chan a power tiller could plough 5 to 10 rai per day [Hanks 1972: 126].

33) Since the deeper water restrains weeds from growing, cross-ploughing is often omitted in plots with water of more than 5 *niu* (12.5 cm) deep.

place for two days. After being sprinkled with water twice a day, the seeds sprout with a primary root of about one centimetre and are then ready for broadcast-sowing. The germinated seeds carried in a *krabung* are sown on the prepared fine mud with the sower moving carefully backwards. The average rate of seeding is two *thang*, the same rate as under the *samruai* method.[34] As in the case of the nursery bed, the water level in the *phǫloei* fields must be carefully controlled. In particular, for about ten days immediately after sowing, the water should be kept off the *phǫloei* fields. When the water level rises because of rain, the farmers must hasten to drain out the water. After the plants take root, their survival in flood water is assured. Thus land preparation of the *phǫloei* method is quite similar to that of transplanting the nursery bed. With respect to water control the *phǫloei* fields may be well regulated with relatively high dikes. Continuous efforts are made to ensure drainage for a certain period after sowing. Subsequently, however, the plots are left alone to be exposed to the encroaching inundation from August onward.

The *samruai* and *phǫloei* are the typical broadcast-sowing methods in Ayutthaya village. But there can be seen, though within a very limited area, another method called *piakniao* which is a hybrid of the two.[35] In a large plot where there are high and dry portions existing together with a swampy portion, ploughing and harrowing but not water controls are possible. So after rough-ploughing and cross-ploughing are done as in the case with the *samruai* method, ungerminated seeds being sown and carefully covered under the soil by harrowing. The *piakniao* method is not necessarily applied to fixed plots in every year, because the condition of puddled areas changes from year to year, due to unstable precipitation at the beginning of the rainy season.

After-cultivation After sowing, though the water may be regulated in the *phǫloei* plots for several days, the typical broadcast-sown field is left basically as it is apart from some weeding. During the ploughing and harrowing, some weeds are turned over and left to rot, while others are removed manually. After sowing, certain kinds of shrub emerge to accompany the growing rice, i.e. *seng* (genus *Corchorus*), *sano (Sesbania)*, *phak bung (Ipomoea)*, *kok hua daeng (Cyperus tegetiformis)* and *kok samriam (Cyperus digitatus)*.[36] Removal of those weeds and grasses is carried out a few weeks after sowing when the plants have rooted strongly. Peasant farmers pull out and

34) In other countries the rate of seeding in wetland sowing is normally higher than in dryland sowing; 112 kg/ha in Bangladesh and 150 kg/ha in the Philippines are reported [Grist 1975: 141–143].

35) For the *piakniao* method practised in Singburi province, see [Tanabe 1979: 6]. Apart from these methods, Wongsanupraphat refers to a peculiar method of broadcast-sowing called *na nam sai*, in which germinated seeds are sown in the extremely deep flooded plots [Wongsanupraphat 1941: 299–300].

36) Although weeding of *phak bung* is difficult, it is perhaps one of the most popular vegetables for Ayutthaya's diet [Grist 1975: 280].

remove them, and at the same time make careful observation of the young rice plants. If they discover sparsely growing and thinly planted portions of the plot, they transplant young plants from densely growing areas.[37] Although hand weeding is still practised from a few weeks after sowing up to mid-August, herbicides introduced about 1970, are now widely applied in both broadcast-sowing and transplanting fields. In 1975, herbicides were used by 36 households or 82 per cent of the 44 operating households of the village. Peasant farmers can purchase herbicides from the Ban Phaen Agricultural Co-operative (*sahakǫn kankaset ban phaen*) or from grocers at Ban Phaen, and can easily apply them to the fields with a sprayer. Application of herbicides is normally made immediately after the young plants take root in July, and seems to lighten the task of hand-weeding to a certain degree. In addition to herbicides, pesticides have recently come into common use in the broadcast-sowing fields. Especially popular are pesticides to control land crabs (*pu na*) which inflict serious damage on young plants [Grist 1975: 335–336].[38] Although farmers cultivating transplanting fields are familiar with the application of fertilizers, the use of fertilizer has not been observed in either *samruai* or *phǫloei* broadcast-sowing fields. As widely seen in the Chao Phraya delta, application of fertilizers is in fact impossible in broadcast-sowing fields subject to deep flooding. The recent widespread use of industrial outputs such as herbicides and pesticides very probably began in 1970 or 1971, together with the introduction of improved plant varieties for early season cultivation. Aside from those tasks mentioned above, no after-cultivation can be done until harvesting time when the flood water subsides in early December.

Harvesting By harvesting time, in December, January and early February, most of the rice stalks exhibit lodging [Grist 1975: 160]. In the 1974–75 cropping season, harvesting continued from 5 December up to early February. Although the sluice at the mouth of the Khanomčhin canal is usually opened to facilitate drainage of the Tontan field, water still remains in many plots until the end of December. Thus, some early varieties of non-floating rice, or so-called *khao kiao kan nam*, which ripen in December must be harvested in the water, using boats for hauling harvested stalks. This is subsequently followed by harvesting of medium-term and late varieties of floating rice or *khao khün nam* in the almost dry fields. The stalks are cut off at an extremely high point about one *sǫk* (50 cm) from the ear in a scooping motion with a deep curved sickle[39]

37) In Bang Chan's transplanted field, such proper replacement of young seedlings are is practised [Kamol 1955: 102].

38) Rats (*nu na*) are another terrible pest prevailing in the Tontan field. The damage caused by rats has been increasing in recent years, though some are caught for food. See Amyot's survey in other parts of Ayutthaya province [Amyot 1976: 123].

39) The deep curved sickle used in the delta is quite different from the Lannathai sickle found in the northern intermontane basins [Watabe 1964: 37; Tanabe 1976: 722–723].

peculiar to the delta area.[39] It is said that such short stalks can easily be carried on a pole (*khan lao*). In floating varieties with a strongly pronounced shattering habit, even a light touch with the ground will cause the grains to fall. As far as the harvesting technique is concerned, there is no basic difference between the *samruai* and *phǫloei* methods.

In the course of broadcast-sowing cultivation, the peak labour requirement is in harvesting, which has to be done rapidly within a limited period. This is in contrast to the transplanting method, where there is another labour peak at transplanting time. In order to meet the intensive labour demand in the harvesting of a relatively large area, many households must depend on labour exchange or *ao raeng*, and on hired labour, to supplement the domestic labour supply. Although the traditional reciprocal labour exchange was widely practised in the past, it seems to have almost disappeared, and at a rather earlier period than elsewhere in the delta, having been mostly replaced by hired labour in the late 1950s.[40] In the village, harvesting by hired labour from outside has also been popular for many decades. Until the late 1960s, most hired labourers were peasants from the North East region or *khon isan* who moved in successive waves to obtain temporary harvesting employment in the villages of the delta region. After the late 1960s, hired labourers from some provinces of the central region replaced labourers from elsewhere, some of them arriving even in the mid-1960s.[41] Hired labourers of this kind work at harvesting the Tontan field, after they have finished harvesting in their own villages, and stay at a temporary field hat (*kratǫp*). Harvesting work is done not by time work based on a daily wage payment but by piece-work for the area to be harvested, the rate being normally contracted with the head of the hired labourers. In 1975, the rate of wage varied from 15 to 20 baht per *ngan* (0.25 rai), or equivalent to 60 and 80 baht per rai respectively, and skilled peasants can normally harvest two *ngan* in a day.

Drying and Bundling The harvested stalks of broadcast-sown paddy are usually left on the ground to dry out in the sun for two or three days. Where the ground is still wet, the stalks are carefully laid on the lodged stubs to dry. In the case of *khao kiao kan nam* harvested in the water, the cut stalks have to be hauled by boat to dry ground in the farm compound. Harvested and dried in the sun, paddy stalks are bundled with dried leaves of *kha* (*Imperata arundinacea*) in the plot where stalks are left to dry. Bundling work (*hǫp khao*) is usually done by the domestic labour of the operating household, but a few households use hired labour at the rate of 30 to 40 baht per 100 bundles.

40) For traditional labour exchage practised in Bang Chan, see [Kamol 1955: 111–114].

41) These provinces are Singburi and Chainat in the upper delta, Saraburi, Lopburi and Prachinburi in the eastern marginal area of the delta, and Nakhǫn Sawan, Phichit and Phitsanulok further to the north.

Hauling The bundled sheaves are set over carrying poles (*khan lao*) and brought out by male farmers from the plots to the roadside, and then taken to the threshing floor by traditional buffalo cart (*lǫ lüan*) or by farm machines such as a small cart attached to a power tiller. Hauling work is basically done by the farmer and his family using their own vehicle, but some households depend on hired vehicles.

Preparation of Threshing Floor As the entire labour force of the household is continuously involved in a series of tasks after harvesting starts, the preparation of a threshing floor (*lan nuat*) should be completed before harvesting. A piece of ground which has been selected for use as a threshing floor is made clean and soaked with water for a night to soften its surface. It is then trampled over by buffaloes for two hours or run over by power tiller, and levelled using a hoe (*chǫp thak*) and wooden scraper (*khatha*) to smooth the surface. Subsequently the floor is left to dry until the evening when it is again soaked with water. Finally, after repeating this process for two or three days, buffalo manure is mixed with water and spread on the floor to fill up the surface completely. Thus a piece of ground which may be rugged or cracked can be improved and made suitable for threshing.

Threshing The sheaves are loosened and spread around in a large circle on the threshing floor using a straw hook (*khan chai*). This work is called *tok khao*. In the traditional method, a pole is usually set in the centre of the floor to which several buffaloes are tied and threshing is done by the trampling of these animals over the sheaves. In former days, exchange of buffaloes (*khǫ raeng khwai*) for threshing was customarily performed in the same way as labour exchange in harvesting, but it has now almost disappeared. At present in place of buffalo threshing, rented power tillers are increasingly used to run over the stalks and thresh out the grain. In 1975 about half of the operating households used a hired power tiller for threshing and its rental fee was 30 baht per 100 bundles. While the tiller or buffaloes work over them, the stalks are raised and turned over by using a straw hook, until the threshing is completed. The grains finally are gathered up using a wooden scraper.

Winnowing After threshing is completed, a winnowing machine (*khrüang si fat*), run either by hand or power, is used to separate the chaff from the grain. Winnowing work is done at the threshing floor usually by the members of the household. After the chaff and other undesirable parts have been removed, the work is finally done and the grain is stored in granary, or prepared for marketing.

The above description of the farming cycle shows that the broadcast-sowing method is strongly dependent on the existing physical environment of which rainfall and inundation are the most decisive factors. Application of the broadcast-sowing method together with suitable selection of indigenous varieties has been

the only feasible way to overcome uncertainty of weather at the beginning of cultivation and prolonged flooding to a considerable depth. In particular adoption of *khao khün nam* which has a growth habit astonishingly well adapted to deep flooding, has enabled the peasant farmers to operate rice agriculture in such a difficult environment. Compared with the transplanting method, the broadcast-sowing method is relatively less labour intensive, especially in the first half of growing period: from land preparation to after-cultivation. In addition, co-operation among peasant farmers in the course of farming operations seems to have been rather scarce except for labour exchange and the exchange of buffaloes. The intensive labour requirement comes only in the harvesting period. As the traditional labour exchange arrangement has almost disappeared, hired labour is the only external resource of labour supply used to supplement the domestic labour force. The broadcast-sowing culture in Ayutthaya today could not survive without such hired labour coming from the outer region of the delta. During the past ten years much of the labour has become mechanized with tractors and power tillers. At the same time, introduction of the early season cultivation has caused a growing dependence on industrial inputs.

3. Transplanting Cultivation in the Early Season

Early season cultivation of transplanted rice was first introduced in the Tontan field in 1970, following the steady progress of water control in the West Bank tracts southwards from the Phraya Banlü canal. In the Tontan field, however, it has not expanded so rapidly, and in 1975 was practised on only 117.25 rai or about 10 per cent of the total operated area, by 14 households. As far as transplanting technology is concerned, it has been widely practised using native varieties in the area wherever feeding water is available at the beginning of the cultivation. But in the case of Ayutthaya village peasant farmers have not been familiar with transplanting cultivation of main season rice to any degree since the pioneering stage many years ago. They have been broadcast-sowing cultivators in the deep inundating area for a century, though acquiring a sufficient knowledge of the transplanting method from neighbours along the Noi river and the Phraya Banlü canal. For the broadcast-sowing cultivators the land naturally watered at the beginning of the rainy season has been simply used as wet-sowing *pholoei* field without any improvement to the plots. Under such circumstances, transplanting technology of the newly developed varieties was introduced, accompanied by the necessary industrial inputs for cultivation. The non-photosensitive varieties for transplanting seem to provide a distinctive cropping pattern, which begins at the end of the dry season and lasts up to August. This is the early season cultivation recently developed in the plots close to the canal.

Varieties In the transplanted plots

close to the canal, non-glutinous varieties RD1 or C4-63, developed as non-photosensitive varieties, are used for early season cultivation. The RD1 is one of the improved varieties released by the Rice Department of the Thai government in 1969, while C4-63 was developed in the College of Agriculture, University of the Phillipines, in 1968 and subsequently became popular in many Southeast Asian countries.[42] Both varieties have a quite short maturation period of about 120 days. These varieties differ from the indigenous ones in that the plant heights are very much lower, being only 90–100 cm, and are locally called low rice or *khao tia*. The yield per rai is considerably higher than those of indigenous varieties and usually attains 40 to 50 *thang*. However, cultivation of these varieties normally requires strict water control in each plot and the application of chemical fertilizer, herbicides and pesticides, as well as transplanting of seedlings, are essential.

Land Preparation In contrast to broadcast-sown plots, transplanted plots must be surrounded by well maintained dikes about 30 cm in height to conserve and control the water. Before land preparation begins the plot is watered by *rahat* or a power pump installed on the bank of the Khanomchin canal. Subsequently the plot is covered with water for two or three days, after which ploughing is carried out using buffaloes or power tillers. Rough-ploughing and cross-ploughing are repeated and finally harrowing is done to break down lumps of clay and remove weeds, followed by levelling the fine mud immediately before transplanting. The water depth should then be kept at 4 *niu* (10 cm) for transplanting.

Nursery Bed The land chosen as a nursery bed (*plaeng kla*) is usually close to the canal from which feeding water can be lifted. Land preparation of the nursery bed begins earlier than in the main plots, and is carried out in the same way. After levelling is completed some shallow ditches are scratched out on the surface for irrigation and drainage as with the case of the *phǫloei* field. The water is then drained off from the nursery bed. The germinated seeds, prepared in advance as in the *phǫloei* method, are carefully broadcast over the bed. On average one *thang* (20 litres or 10 kg) of seed is needed for one rai of the eventual transplanted area, equivalent to only a half of the rate of sowing required in the broadcast-sowing method. Until the seedlings attain a length of 6 to 7 cm, or a week after sowing, the nursery bed must be kept wet, and therefore strict water control is essential. The soil of the nursery bed is thereafter maintained with appropriate moisture, using devices to water when the necessity arises until the time of transplanting. Some 35 or 40 days later, by which time the seedlings are about 40 to 50 cm high, the water is completely drained and the seedlings are left for two days before

42) RD5 released in 1973 is said to be more suitable for deep inundation, but it had not yet been adopted in 1975.

uprooting.[43] Until the time of uprooting and transplanting comes, every stage of the farming operation is performed mostly by the domestic labour force.

Uprooting and Transplanting When the peasant farmers transplant seedlings between late April and mid-May, rainfall is still insufficient, and there is no alternative but to rely entirely on irrigation water lifted from the canal into the transplanting plots. *Rahat* and power pump must be fully at work and intensive labour is essential at this stage. Bunches of seedlings are grasped and pulled out by the handful, roots being strongly smacked against the heel and washed in water to rid them of mud. Two or three handfuls of seedlings are arranged into a bundle, and the top of the leaves is cut off on an arranging board (*paen wang khao kla*) stuck into the nursery bed. Seedling bundles are then immediately hauled by carrying pole to the main plots. Subsequently transplanting (*dam nà*) takes place in the main plot in which the water depth may be kept 4 to 5 *niu* (10 to 12.5 cm). A peasant farmer takes three or four seedlings from a bunch held in the left hand, and inserts them quickly into the mud. Although the interval between stands may be kept about 25 cm, seedlings are planted at random without any rule with the peasant farmer moving backwards.

For the uprooting and transplanting tasks peasant farmers depend primarily upon hired labour. By contrast with harvesting in broadcast-sown fields, hired hands are mostly supplied from inside the village, and outsiders are seldom seen in these operations. Hired labourers are not paid on a daily basis but enter contracts to render labour on a piecework basis called *čhang mao*. Uprooting pays at the rate of 20 baht per 100 bundles; it is possible to do 200 bundles per day. Transplanting pays 20 baht per *ngan* (0.25 rai) and 2 *ngan* can be done in a day. In uprooting and transplanting tasks, there are even cases where the owning household contributes no labour and contracted hired labour has thus taken a new importantce.

After cultivation After transplanting, the rainfall pattern in May is normally still uncertain, so that water control is a matter of very grave concern to the peasant farmers. Until the new plants take roots the water should be retained at a depth of about 5 *niu* (12.5 cm) for a week or ten days to control the growth of weeds.[44] Power devices continuously lift water into the plots in order to keep them wet up to the tillering stage. Thereafter, from June onwards, rainfall and inundation may provide sufficient water. Thus in the transplanted fields, irrigation devices must be appropriately worked from the land preparation in the dry season up to the tillering stage in June and July when the monsoon rainfall becomes stabilized.

43) Some nursery beds, however, are inevitably flooded, because of the volum of water delivered to the main plots.

44) Another purpose of such water regulation is to help water absorption of the young seedlings [Matsuo 1961: 165].

The application of chemical fertilizers is widely seen and is regarded as necessary and effective for the successful cultivation of improved varieties. In many cases about 15 to 27 kg per rai of ammonium phosphate (18–22–0) is applied at tillering stage, 7 to 10 days after transplanting.[45] In five households split application of fertilizer is practised at tillering, and at the time of panicle formation. In recent years herbicides and pesticides have also come into widespread use and their application to the fields is much the same as in the broadcast-sown fields.

Harvesting and Other Operations In the transplanted fields when the paddy has been fully ripened the water is drained as much as possible for convenience of harvesting. Complete drainage is sometimes impossible, because in August the water level in the adjacent area is already rising. As the improved varieties have short stalks, when the paddy is cut at one *sǫk* (50 cm) from the ear, about 40 to 50 cm of stubs are left on the ground. The required labour force is largely supplied from within the village, as in the case in uprooting and transplanting. The piecework wage for harvesting in August is about 15 baht per *ngan*, which is somewhat lower than in broadcast-sown fields in the dry season. This is because during the season, hired hands who have finished their own work in the broadcast-sown fields, are easier to obtain within the village.

After harvesting all necessary operations are carried in the same way as in the main season cultivation. The transplanting cultivation may be finished at the latest by the beginning of September, and thereafter no more crops are planted under the increasing water depth, until the next dry season.[46] With the improved varieties, the early season cultivation is thus designed to be completely finished within the first half of the rainy season. The plot for transplanting cultivation is entirely devoted to such newly introduced rice growing, and therefore it is not associated with the traditional cropping pattern, the only exception being the case of double cropping. For most peasant farmers, the early season cultivation is practised as a substitute for traditional cultivation. Although the transplanting method certainly provides higher yields, the application of the method involves a heavier labour requirement and greater use of industrial inputs throughout the process of cultivation. It may be assumed that the wider application of the transplanting technology, though rather limited at present, will come with further improvement in water control. This will considerably affect the socio-economic condition of the village.

45) One bag containing 40 kg cost 215–250 baht in 1975.

46) It should, however, be noticed that some peasant farmers can harvest another small quantity of ratoon paddy (*khao luk rang*) in the same plots. After the first harvesting, the ratoon crop grows up among the remaining stubble and ripens under the relatively favourable water conditions in higher plots close to the natural levees. About 40 or 45 days after the first harvesting, the remaining stubble give a ratoon yield one-seventh to one-fifth that of the first crop.

4. Farming Equipment

The traditional farming implements used in the village have not changed for many decades since the earliest pioneering age. Most of the items are quite similar to those which have been commonly used throughout the Chao Phraya delta region for many centuries. It is unlikely that any modification or change has been made to any of these implements. Throughout the history of the village, farming tools have not been improved or radically changed, except for the recent introduction of power devices. Therefore, the farming technology depending on such traditional implements has continuously survived until recent years.

Farming technology consists essentially of land preparation by a wooden plough with an iron blade drawn by a water buffalo and various operations which involve much manual labour with rather simple tools.[47] Table 4 shows the essential items of farming equipment which are needed in broadcast-sowing and transplanting cultivation and which are mostly owned by farm operating households. The newly introduced and expensive power devices are also shown in the table. Most of the items of essential equipment listed here were possessed by five households surveyed, while the prices are those given by one of them in 1975. The figures for prices in Bang Chan, which is also located in the delta some twenty miles northeast of Bangkok, are derived from Kamol's survey in 1948 [Kamol 1955: 95–96]. The possession of a complete set of these tools is not absolutely essential for cultivating the land. Many young households cannot afford to purchase expensive equipment such as winnowing machines, and hauling facilities. But they can make use of them by borrowing from relatives and neighbours, and might expect eventually to get them in the future. Especially among relatives, even power devices are subject to free renting. In addition to traditional tools, sprayers for herbicides application and power devices have begun to be prevalent since early 1970s. In particular, the power *rahat* or power pump is essential to operate transplanting early season cultivation.

Most traditional tools are made of wood or bamboo, though some of them are made from metal. Many kinds of relatively simple tool are made in the village by peasants themselves, but metal goods are almost all purchased at the marketplace in the district town of Ban Phaen. It is said that until twenty years ago some kinds of metal goods used to be bought from pedlars and traders plying along the Khanomchin canal. For example, knives brought by traders

47) Ploughs drawn by two buffaloes are not used in the Tontan field. The typical plough (*thai*) consists of a rod (*khan*) and curved handle in which a ploughshare is embeded with an iron coulter. This type of plough is customarily called *thai hua mu* (pig's head plough), because the ploughshare is designed like a pig's head. It seems to be much influenced by the Indian plough, and is different from the triangular type of plough which is popular in the intermontane basins of northern Thailand [Hopfen 1960: 53–54; Watabe 1967: 65; Tanabe 1976: 717–718].

Table 4 Farming Equipment in Ayutthaya Village (1975)

I. Traditional equipment arranged by farming operation

Name of tool (in Thai)	Main material*	Supply**	Price Ayutthaya 1975	Price Bang Chan*** 1948
1) **Land preparation**				
Plough (*khan thai*)	m, w	t	150	80
Yoke including harness (*takhok*)	w	v	0	12
Harrow (*khrat*)	w, b	v, t	50	30
Hoe (*chọp thak*)	m, w	t	20	14
Iron rake (*khrat*)	m, w	t	20	5
Siamese spade (*siam*)	m, w	t	8	3
Soil-carrying basket (*bung ki*)	b	v, t	6	
2) **Water control**				
Water scooping basket (*chong long*)	b, w	v	0	
3) **Sowing**				
Carrying basket (*krabung*)	b	v	0	15
Earthen jar (*ong*)	c	t, p	150	
4) **Transplanting**				
Seedling arranging boad (*paeng wang khao kla*)	w	v	0	
5) **After-cultivation**				
Field knife (*mit*)	m, w	t	20	19
Big curved knife with long handle (*liam*)	m, w	t	20	
6) **Harvesting**				
Large sickle (*khiao na mūang*)	m	t	26	24
Small sickle (*khiao nok thung*)	m	t	26	
7) **Hauling**				
Carrying pole (*khan lao*)	b	t	6	
Buffalo cart (*lọ lūan*)	m, w	v	1,200	
Boat (*rūa phae* or *rūa mat*)	w	t	1,150	386—1,400
8) **Threshing**				
Straw hook (*khan chai*)	m, w	t	20	21
Bamboo rake (*khlat mū sūa*)	b, w	v	0	
Wooden scraper (*khatha*)	w	v	0	
9) **Winnowing**				
Bamboo winnow (*kradong*)	b	v	0	
Winnowing machine (*khrūang si fat*)	m, w	t	700	498
Woven bamboo mat (*ramphaen*)	b	t	25	
Bamboo broom (*maikwat tọk*)	b	v	0	
Coconut broom (*maikwat kam maphrao*)	w	v	0	
10) **Storing and measuring**				
Woven bamboo basket for storing seeds (*phọm*)	b	v	0	
Measuring bin (*thang tuang khao*)	m, w	t	60	

II. Newly introduced equipment

Name of device (in Thai)	Range of price in 1975
Four wheeled power tiller (*rot thai nang khap*)	34,500—45,000
Two wheeled power tiller (*rot thai mū*)	4,500— 6,500
Power *rahat* (*rahat tit khrūang*)	3,750— 4,200
Power pump (*thǫ sup nam*)	5,700— 6,200
Sprayer (*khrūang chit ya*)	80— 350

* m: metal; w: wood; b: bamboo; e: earthenware

** t : town=Ban Phaen; p: peddlers; v: village

*** from Kamol Odd Janlekha. 1955. *A Study of the Economy of a Rice Growing Village in Central Thailand.* Bangkok: The Ministry of Agriculture, 95–96.

from Nakhǫn Luang in Ayutthaya province were once famous for their quality among the peasants throughout the delta region. However, those traders supplying specific equipment have almost disappeared with a few exceptions such as suppliers of earthenwares from Pakkret further downstream of the Chao Phraya main channel.[48] The decline of such trade has apparently been caused by the rapid development of retail shops in Ban Phaen to which transport facilities have much been improved in recent years. Be that as it may, although the supply of metal goods and other industrial products emanates entirely from the marketplace of the town, the villagers are still considerably self-sufficient in wooden and bamboo tools.

The traditional items of equipment are, in general, not very expensive. Although prices in 1975 have certainly risen compared with Bang Chan twenty-seven years ago, the peasant farmers can still afford to buy most of them. Among these items hauling devices and winnowing machines have usually been high-priced equipment. By contrast with the intermontane basins, the boat has been an inevitable hauling and transport facility in the flat delta, even though road traffic has recently improved to a certain degree. Every household has to possess at least one boat not only for cultivation but also for non-agricultural purposes and to maintain daily life in an aquatic environment. As the usage of boats has developed, at least seven different types of boat can be distinguished in the village. On the other hand, the buffalo cart or *lǫ lūan* pulled by a water buffalo is peculiar to the deep flooding area where road traffic has not yet developed.[49] It was still made in the village by a few peasants and sold to others until a few years ago. Most operating households possess one

48) A good example of such traditional trade in Northeast Thailand is given by Anuman [Anuman 1965: 135].

49) This unsophisticated vehicle must be a variant of traditional sled (*lūan*) which could be easily driven on the lodging stubble to haul the harvests from broadcasted fields. The *kwian* pulled by either water buffaloes or oxen, which is popular elsewhere in the country is seldom seen in the deep flooding areas.

Table 5 Ownership of Expensive Devices and Draught Animals by Land Tenure Category (1974—5)

Land tenure category	Number of households (%)	Land preparation			Irrigation		Hauling	
		Buffalo	Four wheeled tiller	Two wheeled tiller	*Rahat*	Pump	Buffalo cart	Boat*
Landlord	2 (3)							2
Landlord-operator	6 (9)	8				1	4	12 (3)
Owner-operator	7 (11)	13	1	1	1	2	7	21 (2)
Part-owner	13 (19)	26	1	2	1	5	12	37 (6)
Tenant	18 (27)	23			2		6	39 (4)
Rural labourer	21 (31)	3						30
Total	67 (100)	73	2	3	4	8	29	141(15)

* The figure in parenthesis indicates the number of boat with engine attached.

of these carts for hauling harvests in the Tontan field, though in recent years some peasants have begun to hire a cart attached to a power tiller for this purpose. The winnowing machine, together with the manually operated *rahat*, is one of the popular farming machines which has been in favour among peasants in this delta since relatively early days.[50] Before the introduction of the hand-winnowing machine in the early 1950s, the peasant farmer would toss his paddy using a wooden spatula, so that cleaned grain fell on the mat and husk and chaff were carried away by the wind. The grains placed on a woven bamboo winnow (*kradong*) were again shaken and tossed many times to be cleaned. This simple winnowing method has almost disappeared in line with the increasingly widespread use of winnowing machines in the late 1960s. Today, hand-winnowing machines, also powerdriven ones are sold in the marketplace at Ban Phaen.

As indicated in the previous sections, the traditional farming technology is rapidly changing through the recent mechanization of farming tools, and the improvement of water conditions. Table 5 shows the possession of these power devices, draught animals and hauling devices by land tenure category. Buffalo cart and boat, the traditional hauling and transport facilities, are possessed by most of households, even though they are relatively expensive. It should be noted in particular, that on average two boats are possessed by a household regardless of land tenure status. By contrast, expensive power tillers and irrigation devices had been purchased in recent years by owner-operators and part-owners who have a comparatively larger operated area. At present, these well-to-do households are the only ones wealthy enough to possess the new devices needed to operate successfully both broadcast-sown and transplanted plots.

50) The hand or foot driven *rahat*, which was commonly used in transplanted fields before the introduction of power driven ones, was not found in the village.

As a result of the strong tendency towards farm mechanization, the water buffalo which has been a typical draught animal in the delta, will shortly disappear. Even though buffaloes were still owned by every farm operating household in 1975, they are apparently being replaced by the hired tractor and power tiller both in land preparation and threshing. Some water buffaloes are no longer employed and are kept only because the peasant farmers dislike the slaughtering of these animals. It can be considered that the traditional plough agriculture, which in the past has relied on water buffaloes and simple equipment, now faces a rapid change. As far as farming tools are concerned, this change is brought about by the introduction of power devices in land preparation and irrigation, the two most crucial steps in the rice-growing operation.

5. Knowledge and Decision

In Ayutthaya village, farming technology seems highly dependent on nature and on the physical environment, which exert a deep influence on success of production. Ayutthaya's technology shows a far greater dependence on the physical environment than the technology of the intermontane basins, especially as regards the traditional broadcast-sowing culture. However, throughout the course of farming operations the peasant farmers in striving towards success in cultivation make careful decisions facing a range of choices in the midst of considerable uncertainty. Throughout the farming process, it is necessary to make a number of decisions based on empirical knowledge. Necessary knowledge of farming technology is basically acquired and accumulated individually by continuous participation in farming from childhood onwards. Children over about ten years, or even younger, contribute considerably to farming operations, helping adult workers. In particular, they usually join in weeding with their parents, and some of the daily supervision of buffaloes, including grazing, has been customarily regarded as the children's main task [Kamol 1955: 103]. Thus, children can acquire sufficient knowledge, working and playing side by side with their parents, by the time they begin to cultivate their own plots as adults. As primary education hardly touches upon farming technology, villagers' knowledge of agriculture seems to be formed entirely on the basis of their own personal experience.

Information about farming is informally conveyed through daily conversation among peasant farmers. In particular, daily communications relevant to farming are extremely frequent among relatives, who live close to each other, often as independent households in the parent compound. Although such information is not systematic, fragments interpolated in the daily conversation are concerned with a wide range of farming matters including the weather, water conditions, growing conditions of the crop, pests, and the price of paddy.

This casual accumulation of information is the major and the most practical basis upon which farming decisions are made. Apart from information gathered within the village, every villager is able to obtain information easily from outside the village; they have easy access to the Ban Phaen marketplace via both road and canal, and radio has already come into common use. Rice traders (*phọkha rapsü khao*) come aboard rice cargo boats (*rüa krachaeng, rüa thọ*) to buy the harvest directly from peasant farmers, and transport rice for sale to rice millers operating along the Nọi river at Ban Phaen, Sikuk and Čhao Čhet. These rice traders coming from both inside and outside the village, provide information about rice marketing to some extent. Most peasant farmers have individually established mutual trust and friendship with such a rice trader over the years [Amyot 1976: 159–166]. It seems, however, that rice traders are rather less interested in transferring detailed knowledge relevant to farming technology to the peasant farmers.[51]

In addition to the informal and individual acquisition of information, the district office to some extent provides administrative guidance to peasant farmers concerning agricultural technology. An agricultural officer or *kaset amphoe* undertakes the task and *kamnan*, or head of *tambon* conveys his suggestion to the villagers in the administrative unit of *tambon*. In 1975 a one-day course concerning the control of rats was given according to the instructions indicated by the agricultural officer. In general, however, official suggestions offered by the district office as well as those of irrigation zone-men have little pronounced effect upon the peasants' behaviour in farming.

Another source of information for decision-making may be agricultural rituals.[52] In the course of farming operations the most significant rituals are those particularly concerned with the rice soul or *khwan khao* which is also called *mae phosop* or Rice Goddess. *Khwan khao* is believed to be something like a soul giving life to the rice, which transmigrates from the seed to the plant. It is always present within the rice whether in field or granary. In order to detain it safely in the rice, seed and plant must be carefully treated, so that a series of *khwan khao* rituals is performed throughout rice-growing.

The first ceremony called *raek na khwan* is held in the plot where broadcast-sowing starts.[53] Before sowing, a *san phiang ta* is erected for the guardian spirit of the plot or *čhao thi čhao thung*. The *san*

51) See Ammar's excellent work for a relevant discussion of the role of middlemen in agricultural marketing [Ammar 1977: 11–15].

52) As stressed by Ford and Moerman, technology is an analytic category that views behaviour as solutions to problems. In this sense, agricultiral ritual is a patterned behaviour and indigenous idea to overcome the uncertainty of rice cultivation [Ford 1942: 555–557; Moerman 1968: 26].

53) The first ploughing ritual or *raek na* commonly practised in other parts of the delta is not found in the village [Anuman 1965: 136–137].

phiang ta, literally, eye level shrine, consists of a roughly made bamboo altar attached to a single wooden pole and adjusted to the adult's eye level (Figure 8). After making an offering of joss sticks and flowers to the spirit, a handful seeds of *khwan khao* which have been reverently kept in the granary since the last harvesting, is mixed with the seeds in the basket. These seeds are at first sown around the *san phiang ta*, asking *mae phosop* or *khwan khao*, for a fruitful year's harvest, and subsequently broadcast-sowing starts in other parts.

The second ritual associated with *khwan khao* is called *tham khwan khao* or invocation of *khwan khao*, which is performed on the day of the full moon of the twelfth lunar month, i.e. on the day of the *lǫi krathǫng* ceremony. Although the ritual is usually held on an auspicious day during the period of panicle formation in October, in Ayutthaya village it takes place on the day of one of the most popular ceremonies in November, when heading has taken place. In the afternoon of the day, a magic pentacle figure made of six bamboo strips called *khaleo*, fixed on a bamboo pole with a red flag on its top, is set up at a corner of the cultivating plot.[54] *Khaleo* is apparently a symbolic fence protecting *khwan khao* from evil spirits and animals. Offerings including some fruits, sweets, and areca nuts (*mak*) are placed in a small bamboo basket and hung up on the *khaleo*. Subsequently peasant farmers chant an incantation to invoke *khwan khao*, while sprinkling Thai perfumes (*namop*) and powder on the plants, and combing the leaves with a comb used for dressing the Rice Goddess. This highly personified ritual is performed at the crucial period of rice-growing between panicle formation and heading, while praying to the *khwan khao* to bring ample harvests.

The third ritual called *raek khao*, or beginning of harvesting, takes place at the onset of harvesting. With just a few words to the spirit of the plot, not to *khwan khao*, the peasants harvest three bunches of stalks, and thereafter harvesting can proceed. When harvesting and hauling of stalks to the threshing floor have been almost completed the fourth ritual of *rap khwan khao* or inviting the *khwan khao* can be seen. With auspicious chanting the peasants make offerings to *khwan khao* in the harvested plot, including two kinds of sweets called *khanom tom daeng* and *khanom tom khao*, a bunch of *namwa* banana, a boiled egg and a lump of boiled rice (*khao pak mǫ*). They then glean grain and stalks left in the harvest plot, and put them in a white garment. While chanting an incantation to invite *khwan khao* they make a straw figure called *tua khwan khao* or *tua mae phosop* from those panicles with grain. This straw figure of the Rice Goddess is dressed in red, yellow and green coloured clothes. The *khwan khao* thus present in the straw figure is conveyed to a corner

54) The magic pentacle figure is called by differing names such as *chaleo* and *thaleo* according to the region [Anuman 1965: 154–155].

of the threshing floor with other gleaned grain. These symbols of *khwan khao* are set there together with offerings similar to those left at the ritual place in the plot. After staying at the threshing floor during threshing and winnowing, the figure in which *khwan khao* resides is stored together with the cleaned new paddy in the granary until the next sowing. The transmigration of *khwan khao* is thus accomplished by this ritual.

It should be noted that these four rituals are all performed at the crucial growing phases of rice cultivation, namely: sowing, panicle formation and heading, harvesting and the end of farming operations. The first and third rituals are clearly associated with the spirit of the land, while the first, second and fourth rituals are symbolic activities representing *khwan khao* or the life of rice itself. The unusual time and space created by these rituals seems to enable the peasant farmers to confirm their confidence in farming operations. It is significant that these agricultural rites in Ayutthaya are primarily performed by each household. The symbolic behaviour in these rites is directed towards the land spirit and *khwan khao* of the individual farm. In Ayutthaya village few agricultural rituals are collectively performed either in groups or by the entire village community.[55] In the intermontane basins a series of rituals associated with the land spirit and *khwan khao* can be widely seen in a quite similar way. In addition to those rituals individually performed in each operating household, some collective agricultural rites are performed; for example the rite of the spirit of irrigation dam (*phi fai*) involves all the members of the irrigation control group, and some rain-making ceremonies are still practised [Tanabe 1976: 760–764]. Be that as it may, most of the agricultural rituals which have survived in Ayutthaya village are strongly suggestive of individual family farming.

With the available resources, knowledge and information, the peasant farmers must first attempt to make some major decisions before commencing cultivation at the beginning of the farming year. The most important of these are decisions about the method and timing of cultivation in the plot, which may determine the agricultural cycle itself throughout the year. As already described in the earlier section, selection of method is almost completely dependent on topography and water conditions, and is especially influenced by access to the canal for the transplanting method of early season cultivation. For the operation of transplanting method, moreover, an expensive device for irrigation, and intensive input of hired labour, must both be secured. Under present conditions of water supply, the possibility of switching of cropping to early season cultivation is thus restricted to a few well-to-do households who have

55) The only exception is a rain-making rite called *hae nang maeo* (parade of female cat) which fell into disuse about thirty years ago. For the *hae nang maeo* rite in central Thailand, see [Anuman 1972: 57–68; Anuman 1954: 39–40; Demaine 1978: 50–51].

preserved land assets or who can rent in operating plots close to the canal. Although early season cultivation overcomes the problem of when to start rice-growing in the midst of environmental uncertainties, decisions about timing are still crucial in both broadcast-sowing methods. Even though peasant farmers start ploughing whenever a power device is available, the decisions concerning the timing of sowing are still of crucial significance due to the instability of monsoon precipitation. After the disappearance of the rain-making rite many decades ago, the recent wide-spread diffusion of radio may enable every peasant to hear weather forecasts. In fact, however, weather forecasts are not entirely reliable, because of the highly localized precipitation pattern at the beginning of the rainy season.[56]

Another major decision has to be made concerning the selection of the seed variety to be sown on the plot concerned. As shown in the earlier section, the selection is made primarily depending on the water conditions of the plot. At the same time, apart from adaptability to ecological conditions, the market price for selling, and the eating quality for consumption may also be important considerations in the selection. Ayutthaya's farming has traditionally been oriented towards markets, so that most peasant farmers dispose of a fair amount of their produce, reserving enough quantity for home consumption. In general, the broadcasting varieties used in the village are not of particularly high quality in the market. However, the villagers know well that in order to secure stable yields under the deep flooding, they have no alternative but to select those varieties. On the other hand, the cooking and eating quality of those broadcasting varieties is said to be fairly satisfactory for their daily consumption.[57] Therefore, there has traditionally been a strong preference for indigenous broadcasting culture both for selling and consumption. Under such variables concerning exchange and use, decisions are made for seed selection which may determine the entire process of farming technology. Ayutthaya's peasants usually choose at least two suitable varieties among a relatively narrow selection, even in a plot which seems to be homogeneous in physical condition. Thus the decisions are dominated by consideration of the principle of safety-first. Although the decisions in method and seed selection are only a first step, villagers take great care to minimize

56) On the contrary, traditional almanacs and calendars arranged by lunar month are still regarded as fairly useful and reliable sources among peasant farmers. The older generations sometimes make use of old manuals to select auspicious days before commencing ritual and farming operations. See Phonlathep's manual on rice-growing and its rituals [Phonlathep 1924: 22–30].

57) In the village, 34 households or 77 per cent of the 44 operating households consume their own home-grown rice. However, in some cases in Ayutthaya province, peasant farmers even dispose of their whole harvest, on the market, because the quality of the product of their the broadcasted fields is inferior for consumption [Amyot 1976: 160].

risks at every stage of the farming operation.[58]

Compared with villages in the intermontane basins, which are still characterized by a backward, subsistence farming, Ayutthaya village has been highly influenced by market economy throughout its history.[59] Whether broadcast-sowing or transplanting culture, Ayutthaya's farming is deeply involved in rice marketing practices. The traditional farming technology, particularly the broadcast-sowing culture, which represents that of subsistence economy in material culture and decision-making, has survived under penetration of market economy without any remarkable changes up to the present. The recent introduction of early season cultivation accompanied by heavy requirement of capital and labour has increasingly affected the traditional technology. Nevertheless, a series of technological decisions of the peasant farmers keeps alive a strong tendency to revert to a peasant economy. The broadcast-sowing culture which is quite rationally adapted to the natural environment, may well continue to exist as the major source of the peasant economy, unless the present water conditions are drastically improved.

58) The peasant's principle of minimizing risks has been observed in other areas of Thailand [Moerman 1968: 68–69; Hanks 1972: 48; Scott 1976: 15–26; SOAS 1978: 35–36].

59) It can be considered, following Myint, that Ayutthaya's peasants are apparently in 'the second phase of the money economy', in contrast to those in the intermontane basins [Myint 1973: 35–38].

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